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No. 19

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## APPLIED SCIENCES

### FUDAN UNIVERSITY REMODELS PROTON ACCELERATOR

Shanghai WEN HUI BAO in Chinese 2 Sep 79 p 2

[Article by Wang Zengfan [3769 1073 5672] and Gu Yongcai [7357 3057 2088]: "Teachers and Students of the Second Physics Department of the Fudan University Build With Their Own Hands a Static Electricity Proton Accelerator"]

[Text] The teachers and students of the accelerator laboratory attached to the Second Physics Department of the Fudan University, giving up their summer vacations and fighting the summer heat, worked on the construction of a static electricity proton accelerator with their own hands in order to better serve scientific research.

In 1959, the students and teachers at the accelerator laboratory attached to the Second Physics Department began to build a static electricity proton accelerator with their own hands. With the help of Xianfong Electric Machinery Plant, in 1969 they began to remodel their original accelerator. In the more than 10 years since then, this accelerator has operated smoothly and has contributed significantly to scientific research work, especially in such fields as proton X-ray fluorescence analysis, bundled foil spectroscopy, back scattering and channel effect and neutron physics.

In order to supplement the domestic need for a low energy level accelerator of 3-4 trillion electron-volt range and to achieve ion beam pulsation, the teachers and the research personnel strongly demanded that this accelerator be remodeled. After the plan was approved by the university authority, the comrades of the accelerator laboratory started their preparations well. Working overtime and accumulating additional points, they finished the assigned tasks for the entire year in the first half of the year. They stopped the machine in mid-July and began to remodel it.

The main objective of this remodeling work was to increase the accelerator's energy level from 3 trillion to 4 trillion electron-volts, and, at the same time, to realize the pulsing capability of the ion beam. The work was expected to be finished in time for the 30th anniversary of the National Day. To achieve this goal, the accelerator had to be remodeled, assembled, tested and adjusted within 2 months. The work, therefore, was not simple.

The members of the laboratory's scientific research groups gave up their summer vacations willingly and even worked on Sundays. Numerous teachers, scientific research personnel and young workers worked very hard in spite of the summer heat, unafraid of dirt or fatigue, eagerly accepting a heavy load and difficult work. Some worked at the front line though ill; the associate professors even worked along with everyone else. Installation of the machinery is progressing at a brisk pace thanks to the comrades' serious attitude and the cooperation of the workers at the machinery repair shop attached to the university.

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APPLIED SCIENCES

STOCHASTIC PLANE WAVE EXPANSION OF OCEAN NOISE SOURCES

Beijing ZHONGGUO KEXUE [SCIENTIA SINICA] in Chinese, Jan 79 pp 33-34

[Article by Xu Zhengyong [6079 4394 6978] of the Acoustics Institute of the Chinese Academy of Sciences: "Expansion of the Partial Spectrum of a Time-Space Stochastic Field of Ocean Noise" (This article was received on 1 August 1977)]

[Text] Abstract

This article concerns the use of stochastic plane wave expansion of ocean noise sources to study the precise statistical time-space structure of a noise field formed by the propagation of oceanic noise through a stratified and inhomogeneous medium. The article also discusses the expansion characteristics of the time-space spectrum of a noise field and introduces the concept of a "partial spectrum of time-space of a noise field."

The article gives the partial spectral function of time and space of a noise field and the physically meaningful and clearcut and generalized relational equation between the partial function and the characteristics of the sources of ocean noise and conditions of propagation. Then the relative function of time and space in an ocean noise field and the directional function of the noise field and their mutual relationship are discussed in detail. Finally the existence of a significant "channel of low noise signals" in deep sea sound channels, in negative transition layers in shallow ocean waters and under a negative sound velocity gradient in shallow ocean waters is proved.

We have studied the relative function of time and space of a noise field in a stochastic ocean communications channel (12). Now we proceed to study the expansion of the partial spectrum of time and space in a stochastic field of ocean noise.

# I

## Expansion of the Partial Spectrum of a Noise Field

### 1. Statistical Model of the Source of Ocean Noise

Besides biological sources of noise that have obvious space and time characteristics, the major sources of ocean noise above frequencies of several hundred hertz are noise sources at the ocean surface (2-7). Noise sources at the ocean surface are generally of the following kinds:

- 1) Radiation of tension waves on the ocean surface.
- 2) Waves caused by sprays of spindrifts.
- 3) Sounds from vibrations and bursting of air bubbles.

Regardless of whether the source of noise is from the radiation of tension waves related to border values, sprays of spindrifts or vibrations of air bubbles, it can be effectively described in mathematical physics as equivalent to a directional plane distribution of a point source.

In the following discussion, we use the right angle coordinate system. The  $z$  axis is perpendicular to the ocean surface. Its positive direction points towards the depth of the sea and the ocean surface is at  $z = 0$ .

Let the plane distribution of the noise source  $\sigma(x, y, t)$  be the stochastic field of equally spaced time and uniform order (generally anisotropic). The dimensionality of the point source on a plane is  $g(\theta, x, y) = g(\theta, i\omega)$ .

It is known from the theory of equally spaced time and uniform order stochastic fields that  $\sigma(x, y, t)$  has a stochastic spectral expansion

$$\sigma(x, y, t) = \int e^{i(k_x x + k_y y - \omega t)} dF_\sigma(k_x, k_y, i\omega),$$

and  $F_\sigma(k_x, k_y, i\omega)$  is the orthogonal incremental process of  $k_x$ ,  $k_y$  and  $\omega$ , where  $k_x$  and  $k_y$  are the component quantities of the wave vector on the  $x$  and  $y$  axis respectively. After substituting into the general function,  $F_\sigma(k_x, k_y, i\omega)$  becomes the differentiable stochastic process of  $k_x$ ,  $k_y$  and  $\omega$  in a wide range of applications, i.e.,

$$dF_\sigma(k_x, k_y, i\omega) = f_\sigma(k_x, k_y, i\omega) dk_x dk_y d\omega,$$

Because of the orthogonality of  $F_\sigma(k_x, k_y, i\omega)$ , we obtain:

$$\begin{aligned} & E[f_\sigma(k_x, k_y, i\omega) f_\sigma^*(k'_x, k'_y, i\omega')] \\ &= E|f_\sigma(k_x, k_y, i\omega)|^2 \delta(k_x - k'_x) \delta(k_y - k'_y) \delta(\omega - \omega'), \end{aligned} \quad (1)$$

where  $E$  represents the statistical average of summation over the series.

## 2. Expansion of the Stochastic Plane Wave of a Plane Directional Noise Source

Let there be a noise source distribution of direction  $g(\theta, i\omega)$  on a plane  $z = 0$  and in the stochastic process let the spectrum density of the source at the source point  $(x', y')$  on the ocean surface be  $\sigma(x', y', i\omega)$ , clearly

$$\sigma(x', y', t) = \int_{-\infty}^{+\infty} \sigma(x', y', i\omega) e^{-i\omega t} d\omega,$$

then at the source point  $(x', y')$ , the contribution  $\delta\Phi(x, y, z, t)$  of the  $dS$  plane element noise source at spatial point  $(x, y, z)$  to the noise field is:

$$\delta\Phi(x, y, z, t) = \left[ \int_{-\infty}^{+\infty} g(\theta, i\omega) \sigma(x', y', i\omega) \frac{e^{i(kr' - \omega t)}}{r'} d\omega \right] dS, \quad (2)$$

where

$$k = \frac{\omega}{c}, \quad r' = [(x - x')^2 + (y - y')^2 + z^2]^{1/2}.$$

First let us study the expansion of directional point source  $g(\theta, i\omega) \frac{e^{ikr'}}{r'}$ .

The directional point source is an abstraction of an objective physical source. In actual physical problems, the size of the "point" of every point source is much smaller than the wave length, and it can only radiate isotropically.

In the study of ocean noise the noise source is actually located within a layer of a definite thickness under the ocean surface. In addition, the existence of the ocean surface is effectively equivalent to a layer of pseudo-source above the ocean surface. Therefore we can abstract this ocean noise source as a directional point source above the ocean surface. Thus, the direction of the point source  $(x', y')$  on the ocean surface  $S$  is equivalent to the summation of radiations of the weighed  $A(z_j)$  distributed along the  $z$  axis at the point source  $(x', y')$ .

According to the expansion equation of the plane wave of the point source when  $z - z_j > 0$ ,

$$\frac{e^{ikr}}{r} = \frac{i}{2\pi} \int_{-\infty}^{+\infty} \frac{1}{k_x} e^{i[k_x(x-x') + k_y(y-y') + k_z(z-z_j)]} dk_x dk_y, \quad (3)$$

From this we can obtain the descriptive equation of the plane wave of the directional point source

$$g(\theta, i\omega) \frac{e^{ikr'}}{r'} = \frac{i}{2\pi} \iint_{-\infty}^{+\infty} \frac{1}{k_z} g(k_z) e^{i[k_x(x-x') + k_y(y-y') + k_z z]} dk_x dk_y, \quad (4)$$

where

$$k_x^2 + k_y^2 + k_z^2 = k^2 = \frac{\omega^2}{c^2}, \quad g(k_z) = \sum_i A(z_i) e^{-ik_z z_i},$$

We see that  $g(k_z)$  is the analytic function of  $k_z$ .

Substituting equation (4) into equation (2) and integrating over the entire ocean surface  $S$  yield

$$\Phi(x, y, z, t) = \iiint_{-\infty}^{+\infty} \frac{i}{2\pi} \frac{1}{k_z} g(k_z) f_0(k_x, k_y, i\omega) \times e^{i[k_x x + k_y y + k_z z - \omega t]} dk_x dk_y d\omega, \quad (5)$$

where

$$f_0(k_x, k_y, i\omega) = \iint_{-\infty}^{+\infty} \sigma(x', y', i\omega) e^{-i[k_x x' + k_y y']} dx' dy'$$

conforming to  $f_0(k_x, k_y, i\omega)$  in equation (1) and also satisfying the relational equation (1).

Equation (5) is the expansion of the plane wave of the plane directional noise source. Thus, the field generated by this noise source under any condition of propagation is the summation of the responses of propagation of this stochastic plane wave series through the propagation medium.

### 3. Expansion of the Partial Spectrum of the Noise Field in a Stratified Medium

In this section, we will study the noise field generated by the noise source under conditions specified above in a stratified and inhomogeneous medium.

The field generated by the equally spaced time and uniform power stochastic plane noise source on the plane  $z = 0$  in a stratified and inhomogeneous medium is also stratified and of equally spaced time and uniform order. That is, when  $z = c$  (constant), the relative function of time and space of the noise field has the following abstract relationship:

$$\begin{aligned} \phi(r_1, r_2, \tau) &= E[p(r_1, t_1)p^*(r_2, t_1 + \tau)] \\ &= E[p(r_1 + h, t_1)p^*(r_2 + h, t_1 + \tau)] \\ &= \phi(r_1 + h, r_2 + h, \tau), \end{aligned} \quad (6)$$

where  $r_1, r_2$  and  $h$  are simultaneously on the plane  $z = c$ .

Equation (6) shows that the stochastic noise field is generally equally spaced in the abstract space  $(x, y, t)$ . We know from the theory of a generally equally spaced stochastic field that this noise field has the following stochastic expansion,

$$p(x, y, z, t) = \iiint e^{i(k_x x + k_y y - \omega t)} dF_p(k_x, k_y, z, i\omega), \quad (7)$$

where  $F_p(k_x, k_y, z, i\omega)$  is the orthogonal incremental process of  $k_x$ ,  $k_y$  and  $\omega$ . Substituted into the general function,  $F_p(k_x, k_y, z, i\omega)$  becomes the differentiable orthogonal incremental stochastic process over a very wide range,

$$dF_p(k_x, k_y, z, i\omega) = f_p(k_x, k_y, z, i\omega) dk_x dk_y d\omega,$$

where  $f_p(k_x, k_y, z, i\omega)$  is called the partial time-space spectrum of the noise field. We thus have

$$p(x, y, z, t) = \iiint f_p(k_x, k_y, z, i\omega) e^{i(k_x x + k_y y - \omega t)} dk_x dk_y d\omega. \quad (8)$$

Looking at equation (8) together with the source relation equation (6), it is obvious that  $f_p(k_x, k_y, z, i\omega) e^{i(k_x x + k_y y - \omega t)}$  is the stochastic field formed when the stochastic plane wave

$$\frac{i}{2\pi} \frac{1}{k_z} g(k_x) f_o(k_x, k_y, i\omega) e^{i(k_x x + k_y y + k_z z - \omega t)}$$

at  $z = 0$  radiates into a stratified inhomogeneous medium. For already determined  $k_x$ ,  $k_y$  and  $\omega$ , we let

$$f_p(k_x, k_y, z, i\omega) = \frac{i}{2\pi} \frac{g(k_x)}{k_z} f_o(k_x, k_y, i\omega) H(k_x, k_y, z, i\omega), \quad (9)$$

where

$$k_z = [k^2(0) - (k_x^2 + k_y^2)]^{1/2}, \quad k(0) = \frac{\omega}{c(0)},$$

$c(0)$  is the speed of sound at  $z = 0$ . Using  $k_z(0)$  to represent  $k_z$  in the above equation allows equation (9) to be written as:

$$f_p(k_x, k_y, z, i\omega) = \frac{i}{2\pi} \frac{g[k_x(0)]}{k_z(0)} f_o(k_x, k_y, i\omega) H(k_x, k_y, z, i\omega). \quad (10)$$

Thus

$$p(x, y, z, t) = \iiint_{-\infty}^{\infty} \frac{i}{2\pi} \frac{g[k_x(0)]}{k_x(0)} f_x(k_x, k_y, i\omega) H(k_x, k_y, z, i\omega) \times e^{i(k_x x + k_y y - \omega t)} dk_x dk_y d\omega, \quad (11)$$

where  $H(k_x, k_y, z, i\omega) e^{i(k_x x + k_y y - \omega t)}$  is clearly the field of the plane wave  $e^{i(k_x x + k_y y - \omega t)}$  at  $z = 0$  radiating into the stratified inhomogeneous medium. This fact becomes obvious when equations (11) and (6) are compared.

By substituting equation (11) into the wave motion equation,

$$\nabla^2 p - \frac{1}{c^2(x)} \frac{\partial^2 p}{\partial t^2} = 0 \quad (\text{where } z > 0)$$

then  $H(k_x, k_y, z, i\omega)$  satisfies the following differential equation

$$\frac{\partial^2}{\partial z^2} [H(k_x, k_y, z, i\omega)] + [k^2(x) - (k_x^2 + k_y^2)] H(k_x, k_y, z, i\omega) = 0, \quad (12)$$

where  $k(x) = \omega/C(x)$ ,  $C(z)$  is the distribution of the speed of sound along  $z$ . The function  $H(k_x, k_y, z, i\omega)$  can be represented as:

$$H(k_x, k_y, z, i\omega) = c_1 h_1(k_x, k_y, z, i\omega) + c_2 h_2(k_x, k_y, z, i\omega),$$

where  $h_1(k_x, k_y, z, i\omega)$  and  $h_2(k_x, k_y, z, i\omega)$  are a pair of linearly independent solutions of equation (12). The coefficients  $c_1$  and  $c_2$  are also functions of  $k_x$ ,  $k_y$  and  $\omega$  determined by actual conditions of propagation.

In the following, examples of  $c_1$ ,  $c_2$ ,  $h_1$  and  $h_2$  in a shallow ocean layer of homogeneous velocity and under negative and positive gradients are given. The results in deep sea conditions can also be obtained.

(1) In the Medium of a Layer of Homogeneous Velocity (of Ocean Depth  $d$ ).

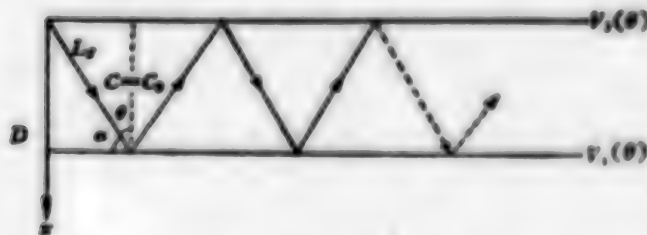


Figure 1 Sound waves are reflected many times at the borders

As Figure 1 shows, when the reflection coefficient of the ocean surface is  $V_s(\theta)$ , and the reflection coefficient of the ocean bottom is  $V_b(\theta)$ , and the layer is homogeneous, the two linearly independent solutions of equation (12) are

$$A_1 = e^{ik_z z}, \quad A_2 = e^{-ik_z z}.$$

The field's response function  $H(k_x, k_y, z, i\omega)$ , as shown in Figure 1 is the unit plane wave radiating into the layer at  $z = 0$  and being reflected many times between the ocean surface and ocean floor.

$$H(k_x, k_y, z, i\omega) = c_1 A_1 + c_2 A_2.$$

When  $k_x^2 + k_y^2 \leq \omega^2/C^2(0)$ ,

$$\begin{aligned} c_1 &= 1 + V_s(k_x)V_b(k_x)e^{ik_z D} + \dots + [V_s(k_x)V_b(k_x)]^n e^{ik_z D} + \dots \\ &= \frac{1}{1 - V_s(k_x)V_b(k_x)e^{ik_z D}}, \\ c_2 &= V_s(k_x)e^{ik_z D} + V_s(k_x)V_b(k_x)e^{ik_z D} + \dots + V_s^{n+1}(k_x)V_b^n(k_x)e^{ik_z D} + \dots \\ &= V_s(k_x)e^{ik_z D}c_1. \end{aligned}$$

If absorption of the heat or sound waves by the medium is considered when its absorption coefficient is  $\alpha(\omega)$ , then

$$\begin{aligned} c_1 &= \frac{1}{1 - V_s V_b e^{-\alpha \omega L_1 + ik_z D}}, \\ c_2 &= V_s c_1 e^{-\alpha \omega L_1 + ik_z D}, \end{aligned} \quad (13)$$

where

$$L_1 = \frac{2D}{k_z}, \quad k_z = \frac{2D}{\sin \alpha}, \quad k_z = (\omega/c) \sin \alpha.$$

$$\text{for } k_x^2 + k_y^2 \geq \frac{\omega^2}{C^2(0)}, \quad k_z = [k^2 - (k_x^2 + k_y^2)]^{1/2}$$

is an imaginary number,  $e^{ik_z z}$  represents the inhomogeneous plane wave which undergoes exponential attenuation as  $z$  increases. At this moment,

$$c_1 \approx 1, \quad c_2 \approx 0, \quad \text{and thus } H(k_x, k_y, z, i\omega) \approx e^{ik_z z}.$$

## (2) Distribution of Negative Sound Velocity Gradient

Under a negative velocity gradient of sound illustrated in Figure 2, we will separately discuss the following three cases.

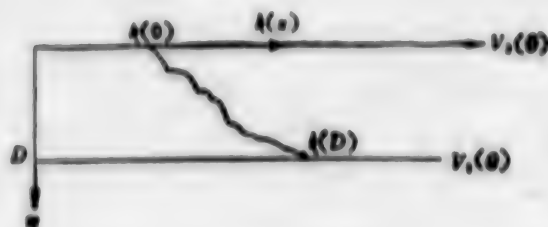


Figure 2 A typical negative sound velocity gradient and distribution

1) When  $k_x^2 + k_y^2 \leq k^2(0)$

Using WKB approximation we can obtain the two linearly independent solutions of equation (12):

$$\begin{aligned} h_1 &= q^{1/2}(0, k_x, k_y) q^{-1/2}(x, k_x, k_y) e^{i \int_0^x q(z, k_x, k_y) dz}, \\ h_2 &= q^{1/2}(0, k_x, k_y) q^{-1/2}(x, k_x, k_y) e^{-i \int_0^x q(z, k_x, k_y) dz}, \\ q(x, k_x, k_y) &= [k^2(x) - (k_x^2 + k_y^2)]^{1/2} = k_z(x), \\ k(x) &= \omega/C(x), \\ H(k_x, k_y, x, i\omega) &= c_1 h_1 + c_2 h_2. \end{aligned}$$

This is similar to the condition in a homogeneous layer where the wave being considered is reflected many times in the layer between the ocean floor and ocean surface. We have

$$\begin{aligned} c_1 &= \frac{1}{1 - V_1[k_x(D)] V_2[k_x(0)] e^{2i \int_0^D q(z, k_x, k_y) dz}}, \\ c_2 &= V_1[k_x(D)] c_1 e^{-2i \int_0^D q(z, k_x, k_y) dz}. \end{aligned}$$

If absorption of heat by the medium is considered, then

$$\begin{aligned} c_1 &= \frac{1}{1 - V_1[k_x(D)] V_2[k_x(0)] e^{-\alpha(\omega)L_s + 2i \int_0^D q(z, k_x, k_y) dz}}, \\ c_2 &= V_1[k_x(D)] c_1 e^{-\alpha(\omega)L_s + 2i \int_0^D q(z, k_x, k_y) dz}, \end{aligned} \quad (14)$$

where  $L_s$  is the length of one span of the wave lines corresponding to  $k_x$  and  $k_y$  as shown in Figure 3.

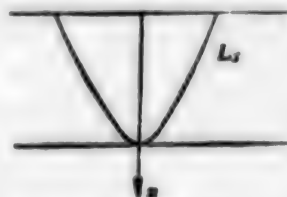


Figure 3 One span of the wave line

2) The values of  $k_x, k_y$  when  $k^2(0) \leq k_x^2 + k_y^2 \leq k^2(D)$

The values of  $k_x$  and  $k_y$  have a reverse point  $Z$  such that

$$k^2(Z) = k_x^2 + k_y^2.$$

$q^2(z, k_x, k_y)$  near  $z = Z$  can be expanded:

$$q^2(z, k_x, k_y) = b(z - Z).$$

When  $Z$  is not very near the surface, the following two linearly independent solutions of equation (12) that satisfy the fixed solutions here can be derived from the theory of propagation.

$$h_1 = \begin{cases} q^{-1/2}(z, k_x, k_y)e^{iu}, & \text{when } z < Z, \\ \sqrt{\pi/2} \left(\frac{2}{3b}\right)^{1/6} e^{-\frac{2}{3}iu} u^{1/3} H_{1/3}^{(1)}(u), & \text{when } z \approx Z \\ q^{-1/2}(z, k_x, k_y)e^{iu}, & \text{when } z > Z \end{cases}$$

$$h_2 = \begin{cases} q^{-1/2}(z, k_x, k_y)e^{-iu}, & \text{when } z < Z \\ \sqrt{\pi/2} \left(\frac{2}{3b}\right)^{1/6} e^{-\frac{2}{3}iu} u^{1/3} [e^{i\pi/3} H_{1/3}^{(1)}(u) + H_{1/3}^{(2)}(u)], & \text{when } z \approx Z \\ q^{-1/2}(z, k_x, k_y)[e^{-iu} - ie^{iu}], & \text{when } z > Z \end{cases} \quad (15)$$

where  $u = \int_z^0 q(z, k_x, k_y) dz, \quad H_{1/3}^{(1)}(u)$

is a Hankel function of the first kind of order  $1/3$ ,  $H_{1/3}^{(2)}(u)$  is a Hankel function of the second kind of order  $1/3$ .

The physical meaning of  $h_1$  when  $z < Z$  is an inhomogeneous plane wave. It undergoes exponential attenuation as  $z$  increases and after passing the reverse point  $Z$ , it propagates in the direction of  $z$ . The physical meaning of  $h_2$  is when  $z > Z$ , and it propagates in the negative direction of  $z$  until it reaches  $z = Z$ , reverses and propagates in the positive direction of  $z$ . The reverse coefficient is  $-1$ . When  $z < Z$ , it undergoes exponential attenuation as  $z$  decreases.

By a similar course of reasoning we obtain

$$\begin{aligned} c_1 &= q^{1/2}(0, k_x, k_y) e^{i \int_0^Z q(z, k_x, k_y) dz}, \\ c_2 &= \left[ \frac{V_1[k_z(D)] e^{2i \int_Z^D q(z, k_x, k_y) dz}}{1 + i V_1[k_z(D)] e^{2i \int_Z^D q(z, k_x, k_y) dz}} \right] c_1. \end{aligned} \quad (16)$$

3) When  $k^2(D) \leq k_x^2 + k_y^2$ , the field poles corresponding to each  $k_x, k_y$  are extremely weak and can be deleted.

### (3) Distribution of Positive Sound Velocity Gradient

Here we list the results without any further and special explanation.

1) The values of each  $k_x, k_y$  corresponding to  $k^2(0) \leq k_x^2 + k_y^2$  contribute very minutely to the entire noise field and are deleted.

2) When  $k_x^2 + k_y^2 < k^2(D)$ ,

$$\begin{aligned} h_1 &= q^{1/2}(0, k_x, k_y) q^{-1/2}(z, k_x, k_y) e^{i \int_0^z q(z, k_x, k_y) dz}, \\ h_2 &= q^{1/2}(0, k_x, k_y) q^{-1/2}(z, k_x, k_y) e^{-i \int_0^z q(z, k_x, k_y) dz}, \\ c_1 &= \frac{1}{1 - V_1[k_z(D)] V_2[k_z(0)] e^{-i(\omega) L_z + 2i \int_0^D q(z, k_x, k_y) dz}}, \\ c_2 &= V_1[k_z(D)] c_1 e^{-i(\omega) L_z + 2i \int_0^D q(z, k_x, k_y) dz}. \end{aligned}$$

3) When  $k^2(D) \leq k_x^2 + k_y^2 \leq k^2(0)$ , it can be proven that

$$\begin{aligned} H(k_x, k_y, z, i\omega) &= \\ &\begin{cases} A q^{1/2}(0, k_x, k_y) e^{i \int_0^z q(z, k_x, k_y) dz} \\ \quad \times [q^{-1/2}(z, k_x, k_y) (e^{i \int_z^D q(z, k_x, k_y) dz} - i e^{-i \int_z^D q(z, k_x, k_y) dz})], & \text{when } z < Z \\ A q^{1/2}(0, k_x, k_y) e^{i \int_0^z q(z, k_x, k_y) dz} & \text{when } z \approx Z \\ \quad \times \sqrt{\pi/2} \left(\frac{2}{3b}\right)^{1/6} e^{i \frac{3}{2} \pi} u^{1/3} H_{1/3}^{(1)}(u), & \text{when } z > Z \\ A q^{1/2}(0, k_x, k_y) q^{-1/2}(z, k_x, k_y) e^{i \int_0^z q(z, k_x, k_y) dz}, \end{cases} \end{aligned}$$

where  $u = \int_z^D q(z, k_x, k_y) dz$ , and  $z$  is the reverse point,

$$A = \frac{1}{1 + i V_2[k_z(0)] e^{-i(\omega) L_z + 2i \int_0^D q(z, k_x, k_y) dz}}.$$

## II

### The Relative Time-Space Function and the Partial Directional Function in An Ocean Noise Field

#### 1. The Relative Time-Space Function in a Noise Field

The relative time-space function in an ocean noise field  $\phi(r_1, r_2, \tau)$  is defined as follows:

$$\phi(r_1, r_2, \tau) = E[p(r_1, t)p^*(r_2, t + \tau)], \quad (17)$$

where  $E$  represents the statistical average of summation over the series.

Let  $r_1 = (x_1, y_1, z_1)$ ,  $r_2 = (x_1 + x, y_1 + y, z_2)$ , 则  $r_2 - r_1 = (x, y, z_2 - z_1)$ .

Substituting the descriptive equation of the partial spectrum of the noise field (11) into equation (7) and using the relational equation (1) to complete integration yield

$$\begin{aligned} \phi(r_1, r_2, \tau) = & \iiint_{-\infty}^{+\infty} \frac{|g[k_z(0)]|^2}{|k_z(0)|^2} E|f_o(k_x, k_y, i\omega)|^2 H(k_x, k_y, z_1, i\omega) \\ & \times H^*(k_x, k_y, z_2, i\omega) e^{-i(k_x x + k_y y - \omega \tau)} dk_x dk_y d\omega. \end{aligned} \quad (18)$$

Equation (18) is the most generalized descriptive equation of the relative time-space function in a natural ocean noise field. The effects of the conditions of propagation upon the relative function is represented by

$H(k_x, k_y, z, i\omega)$ . The approximation formula of the function  $H(k_x, k_y, z, i\omega)$  can be easily obtained. The solutions of three hydrological conditions of the shallow ocean model have already been given above. Solutions can be similarly obtained for deep sea conditions. Equation (18) expresses the effect of the statistical characteristics of the noise source upon the relative function of the noise field by  $g[k_z(0)]$  and  $E|f_o(k_x, k_y, i\omega)|^2$ .

In the study of noise source,  $g[k_z(0)]$  generally has the following expression:

$$g[k_z(0)] = \sum_{n=1}^N A_n k_z^n(0),$$

when  $A_n$  is related to the waves on the ocean surface. In the dipole noise source radiation model,  $g[k_z(0)] = A k_z(0)$ .

Under the important condition of independent spacial distribution of a noise source with dipole radiation,  $E|f_o(k_x, k_y, i\omega)|^2 = F_o(\omega)$ , where  $F_o(\omega)$  is the power spectrum over the course of the noise source. Equation (18) can be further simplified to the following descriptive equation:

$$\psi(r_1, r_2, \tau) = \int_{-\infty}^{+\infty} \int_{-\infty}^{+\infty} F_o(\omega) H(k_x, k_y, z_1, i\omega) H^*(k_x, k_y, z_2, i\omega) \times e^{-i(k_x x + k_y y - \omega \tau)} dk_x dk_y d\omega. \quad (19)$$

In a stratified inhomogeneous medium

$$H(k_x, k_y, z, i\omega) = H(\nu, z, i\omega)$$

where  $\nu = (k_x^2 + k_y^2)^{1/2}$ .

Transformation of the coordinates

$$k_x = \nu \cos \varphi, \quad k_y = \nu \sin \varphi, \quad r = (x^2 + y^2)^{1/2},$$

and substitution into equation (19) yield

$$\psi(r_1, r_2, \tau) = \int_{-\infty}^{+\infty} \int_{-\infty}^{+\infty} F_o(\omega) H(\nu, z_1, i\omega) H^*(\nu, z_2, i\omega) \times 2\pi J_0(\nu r) e^{i\omega \tau} \nu d\nu d\omega, \quad (20)$$

where  $J_0(\nu r)$  is the zero order Bessel function.

2. The Dimensional Function  $L(z)$  of the Partial Spectrum of a Noise Field and the Directional Function  $G(\theta, \varphi, z)$

Starting with the partial decomposition of equation (11) of a noise field when  $H(k_x, k_y, z, i\omega)$  it can be expanded near  $z_0$  by the use of the WKB approximation as:

$$H(k_x, k_y, z, i\omega) \simeq d_1(k_x, k_y, z_0, i\omega) e^{ik_x z_0 (z - z_0)} + d_2(k_x, k_y, z_0, i\omega) e^{-ik_x z_0 (z - z_0)}, \quad (21)$$

where a "dimensional function of a partial spectrum"  $L(z_0)$  is defined here as  $L(z_0) = \min\{z_1 - z_{-1}, z'_1 - z'_{-1}\}$ , and in which  $z_1, z_{-1}$  and  $z'_1, z'_{-1}$  represent the solution of  $F_1(z, z_0) = A_1$  and  $F_2(z, z_0) = A_2$  respectively at the immediate neighborhood of  $z_0$ .

$$F_1(z, z_0) = \left| \int_{z_0}^z q(z, k_x, k_y) - q(z_0, k_x, k_y) dz \right|,$$

$$F_2(z, z_0) = \left| \frac{1}{q(z_0, k_x, k_y)} [q(z_0, k_x, k_y) - q(z, k_x, k_y)] \right|,$$

$\Lambda_1, \Lambda_2$  are much smaller than 1 and their actual numerical values are selected according to the situation and nature of the problem. Obviously, when  $|z - z_0| < L(z_0)$ , equation (21) is valid. Substituting equation (21) into equation (11) yields

$$p(r, t) = P_I + P_{II},$$

where

$$\begin{aligned} P_I &= \frac{i}{2\pi} \iiint_{-\infty}^{+\infty} \frac{g[k_x(0)]}{k_x(0)} f_0(k_x, k_y, i\omega) d_1(k_x, k_y, z_0, i\omega) \\ &\quad \times e^{i(k_x x + k_y y + k_z(z_0)z - \omega t)} dk_x dk_y d\omega, \\ P_{II} &= \frac{i}{2\pi} \iiint_{-\infty}^{+\infty} \frac{g[k_x(0)]}{k_x(0)} f_0(k_x, k_y, i\omega) d_2(k_x, k_y, z_0, i\omega) \\ &\quad \times e^{i(k_x x + k_y y - k_z(z_0)z - \omega t)} dk_x dk_y d\omega, \end{aligned} \quad (22)$$

$$k_z(z_0) = [k^2(z_0) - (k_x^2 + k_y^2)]^{1/2}.$$

From equation (22) we obtain the partial directional function

$$G(\theta, \varphi, z_0) = G_1(\theta, \varphi, z_0) + G_2(\theta, \varphi, z_0),$$

$$\begin{aligned} G_1(\theta, \varphi, z_0) &= \frac{|g[k_x(0)]|^2}{(2\pi)^2 |k_x(0)|^2} (E |f_0(k_x, k_y, i\omega)|^2 |d_1(k_x, k_y, z_0, i\omega)|^2, \\ \theta &= \cos^{-1} \frac{[k^2(z_0) - (k_x^2 + k_y^2)]^{1/2}}{k(z_0)}, \quad 0 \leq \theta \leq \frac{\pi}{2}, \end{aligned} \quad (23)$$

$$\varphi = \tan^{-1} \frac{k_y}{k_x}, \quad 0 \leq \varphi \leq 2\pi.$$

As Figure 4 shows,  $G_1(\theta, \varphi, z_0)$  and  $G_2(\theta, \varphi, z_0)$  simply change  $d_1(k_x, k_y, z_0, i\omega)$  in equation (23) to  $d_2(k_x, k_y, z_0, i\omega)$  and

$$\theta = \pi - \cos^{-1} \frac{[k^2(z_0) - (k_x^2 + k_y^2)]^{1/2}}{k(z_0)}, \quad \frac{\pi}{2} < \theta \leq \pi.$$

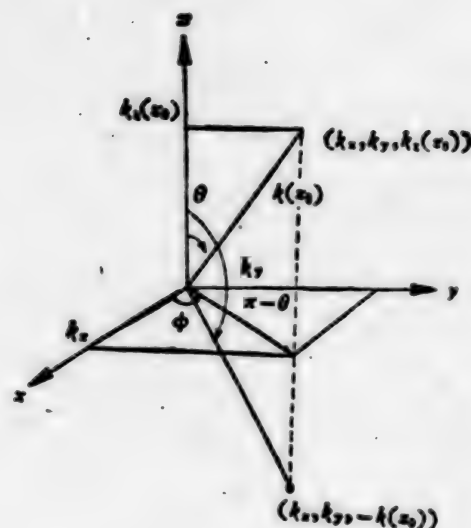


Figure 4

From this we can point out the following points:

- 1) Except the fact that the distribution of the sound velocity in the medium acts like that in a homogeneous layer, the directional function changes as  $z$  changes.
- 2) At  $z \approx Z$ , i.e., the point of reverse,  $L(Z) = 0$ , and the concept of partial directionality can not be applied.
- 3) In dealing with sound signals in water, computations concerning directionality will only be effective when the linear degree in the direction of  $z$  of the base is smaller than  $L(z)$ .
- 4) The total energy of the noise field at  $z_0$  does not equal the integration of directionality of the noise field over the entire unit sphere, i.e.,

$$U(z_0) \neq \int_{\Omega} G(\theta, \varphi, z_0) d\Omega.$$

### 3. The Relationship Between the Partial Directional Function of the Noise Field and the Relative Time-Space Function

According to equation (18), we can study the relationship between the partial directional function of the noise field and the relative function.

Let  $L(z_0) = 0$  at  $z = z_0$ . Let  $x_1 = z_0 - \frac{\pi}{2}$ ,  $x_2 = z_0 + \frac{\pi}{2}$  and  $|x_1 - x_2| < L(z_0)$

then the  $HH^*$  in equation (18) can be expanded as follows:

$$\begin{aligned} H(k_x, k_y, z_1, i\omega) H^*(k_x, k_y, z_1, i\omega) &\simeq \\ &= |d_1(k_x, k_y, z_0, i\omega)|^2 e^{-i k_z(z_1 - z_0)} + |d_2(k_x, k_y, z_0, i\omega)|^2 e^{i k_z(z_1 - z_0)} \\ &\quad + 2 \operatorname{Re}[d_1(k_x, k_y, z_0, i\omega) d_2^*(k_x, k_y, z_0, i\omega)]. \end{aligned} \quad (24)$$

By substituting the above equation into equation (18), applying equation (23) and rearranging the terms we obtain:

$$\begin{aligned}\phi(r_1, r_2, \tau) &= \phi_I + \phi_{II}, \\ \phi_I &= \iiint_{-\infty}^{+\infty} \tilde{G}(k_x, k_y, k_z(z_0)) e^{-i(k_x x + k_y y + k_z(z_0) z - \omega \tau)} dk_x dk_y dk_z(z_0), \\ \phi_{II} &= \iiint 2\text{Re}[d_1 d_2^*] \frac{|g(k_z(0))|^2}{|k_z(0)|^4} E |f_0(k_x, k_y, i\omega)|^2 \\ &\quad \times e^{-i(k_x x + k_y y - \omega \tau)} dk_x dk_y d\omega.\end{aligned}\quad (25)$$

where  $\phi_I$  in the above is entirely consistent with the Eckart [8] relationship between a relative function and directionality while the term reflects the mutual interference of noise fields of different directions.

The famous Eckart relationship between energy flow and relative function is obtained under a homogeneous anisotropic noise field. In a generalized stratified and inhomogeneous medium, an interference term  $\phi_{II}$  must be added.

### III

#### The Statistical Characteristics of Noise Output in Treating Time-Space Signals

Classically, the treatment of sound signals of water is expressed by weighted time and space over a field. Its boxed diagram is illustrated in Figure 5.

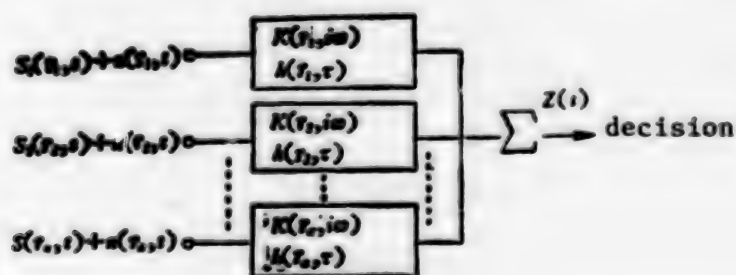


Figure 5

If the noise field is a Gauss type, then as in Figure 5, treatment of the sound signals of water is generally a linear treatment of time and space over the field. The process of noise output  $Z(t)$  is also a Gauss process. Thus it is sufficient to study only the relative function of  $Z(t)$  or the power spectrum.

Using Diagram 5 and equation (11) we can obtain

$$Z(t) = \iiint \frac{g[k_z(0)]}{k_z(0)} f_r(k_r, k_y, i\omega) e^{-i\omega t} \times \left[ \sum_{j=1}^n K(r_j, i\omega) H(k_r, k_y, z_j, i\omega) e^{i(k_r x_j + k_y y_j)} \right] dk_r dk_y d\omega. \quad (26)$$

Let

$$\Phi(k_r, k_y, i\omega) = \sum_{j=1}^n K(r_j, i\omega) H(k_r, k_y, z_j, i\omega) e^{i(k_r x_j + k_y y_j)}.$$

Obviously  $\Phi(k_r, k_y, i\omega)$  constitutes a time-space wave filter. It not only relies on the network transmission function  $K(r_j, i\omega)$  of the receiver but also relies on the function  $H(k_r, k_y, z, i\omega)$  related to the conditions of propagation and geometric positions of the receivers.

The relative function of  $Z(t)$  after treatment of time and space of a noise field is

$$\psi_z(\tau) = E[Z(t)Z^*(t + \tau)]. \quad (27)$$

Substituting equation (26) into equation (27) yields

$$\psi_z(\tau) = \int_{-\infty}^{+\infty} S_z(\omega) e^{i\omega\tau} d\omega,$$

where

$$S_z(\omega) = \iint \frac{|g[k_z(0)]|^2}{|k_z(0)|^2} E|f_r(k_r, k_y, i\omega)|^2 \times |\Phi(k_r, k_y, i\omega)|^2 dk_r dk_y, \quad (28)$$

$S_z(\omega)$  is the power spectrum of output  $Z(t)$ .

#### IV

##### Channel of Low Noise Signals and Application of Automatically Adaptive Filtering in the Channel of Low Noise Signals

It is known from the above analysis of the partial spectrum of a noise field that under many conditions a channel of low noise signals does exist in detection and communication of sound signals in water. The presence of such a channel of low noise signals is very significant in underwater acoustic detection.

It is not difficult to see in the study of the expansion of the partial spectrum of a ocean noise field that an acoustic channel of low noise signals exists in negative gradient shallow seawater, negative transition layers and deep sea sound channels. Now let us analyze the question of the channel of low noise signals under some frequently seen and typical conditions having a negative sound velocity gradient.

A typical distribution of the velocity of sound is shown in Figure 6. The range of variation of  $d_0$  is between several meters and ten or more meters, and  $\Delta C = C(0) - C(D)$  can reach 30 meters/second. The length of  $D - d_1$  is about several dozen meters. As illustrated in Figure 6, the dimensional function of the partial spectrum at the sea floor is  $L(D) \approx (D - d_1)$

We know from the expansion of the partial spectrum of a noise field of a distribution of negative velocity gradient of sound that the noise field under such a condition is formed by the summation of the following two kinds of stochastic plane waves.

$$1) \quad k_x^2 + k_y^2 \leq k^2(0)$$

The directional function  $G_1(\alpha, \varphi)$  of these stochastic plane waves at

$z = D$  when  $|\alpha| < \sin^{-1} \sqrt{\frac{2\Delta C}{C_0}}$  is  $G_1(\alpha, \varphi) = 0$ , as a few simple

calculations show. As illustrated in Figure 7,  $\alpha$  is the angle between the wave vector quantity and the water surface,  $\Delta C = C(0) - C(D)$ .

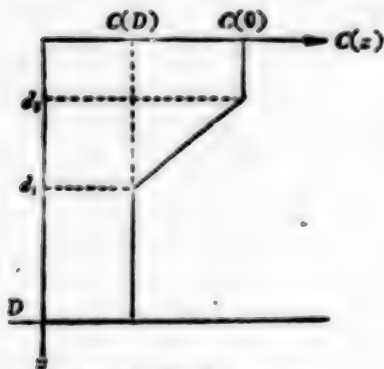


Figure 6



Figure 7

$$2) \quad k^2(0) \leq k_x^2 + k_y^2 \leq k^2(D)$$

The directional function  $G_2(\alpha, \varphi)$  formed by these stochastic plane

waves at  $z = D$  are distributed within  $|\alpha| \leq \sin^{-1} \sqrt{\frac{2\Delta C}{C_0}}$ . It is known from equation (16) that

$$G_2(\alpha, \varphi) \propto \int_0^D e^{i(k_x^2 + k_y^2)z} dz = \int_0^D e^{i(k^2 - k_z^2)z} dz = \int_0^D \sqrt{2\Delta C / C_0} dz, \quad (29)$$

where  $k^2 = k_x^2 + k_y^2$ .

The  $\alpha$  value at the sea floor  $z = D$  is determined by  $v$

$$\alpha = \cos^{-1} \frac{v}{k(D)},$$

$Z$  is the reverse point, and if  $d_0 = 10$  meters, then  $Z > 10$  meters.

It is known from equation (29) that when  $|\alpha| < \sin^{-1} \sqrt{\frac{2\Delta C}{C_0}}$   $G_A(\alpha, \varphi)$

rapidly drops as  $\alpha$  reduces. In fact, when  $|\alpha|$  is smaller than the value

$\alpha_0 = \sin^{-1} \sqrt{\frac{2\Delta C}{C_0}}$ , attenuation of  $G_A(\alpha, \varphi)$  is very large and in actual situations it can reach above 60 decibels.

When  $\Delta C = 35$  meters/second,  $\alpha_0 \approx 12^\circ$ , and at this time, there is almost no noise field energy flow within  $|\alpha| < 12^\circ$ .

A vertical underwater sound listening post was designed and set at the bottom of the sea with main arm plates at  $\Delta\theta < 24^\circ$ , and side arm plates situated at a very low position. We carefully studied its potential to resist interference. The result was astonishing. At the same time we also analyzed the undetectable blind area of the "channel of low noise signals" and proposed ways to overcome it. The effect of the height spectrum of the unevenness of the sea bottom upon the function of the channel of low noise signals is mainly the redirected radiation of plane waves of the noise field at  $|\alpha| > \alpha_0$  into  $|\alpha| < \alpha_0$ . Under ordinary conditions, the potential to resist interference of the "channel of low noise signals" is still astonishing.

The difficulty in realizing the technique of using a "channel of low noise signals" is the fluctuation of the sensitivity of the underwater sound listening device seriously destroys its potential to resist interference. Here we can use the automatic adaptation of the LMS computational method (9) to solve the problem by adjusting the weighted function of the sensitivity of the underwater listening device. Details will not be discussed here but will be prepared for discussion in another article.

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## APPLIED SCIENCES

### 'XINHUA' CITES SCIENTIFIC ACHIEVEMENTS IN SHANGHAI

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[Text] Shanghai, 8 Oct (XINHUA)--The Shanghai Institute of Metallurgy under the Chinese Academy of Sciences has developed the ECL 1024 bit random access memory that is up to advanced world standard. It contains 9087 elements and uses double level metallization.

Since the beginning of this year, Shanghai has achieved important scientific research results in over 170 items, 13 up to advanced world levels. Included are the most advanced branches of science and technology in electronics, lasers, infrared rays, vacuums and atomic energy as well as research in basic theory and applied technology.

China's first large automatic distribution photometer was jointly developed by the Chinese Institute of Metrology and Fudan University and the performance is up to advanced world standards.

The newly developed 120-channel optical fiber communications system can transmit teletype, telephone and letter-phone and also facsimile and color-television.

Fudan University carried out theoretical and research on impurities and defects in semiconductor materials and devised methods to control them. This has increased the rate of satisfactory finished products.

A scientific treatise, "clinical practice and theoretical study of liver cancer in the early stage", by the liver cancer research group of the Shanghai No. 1 Medical College, is considered an important development.

CSO: 4020

## APPLIED SCIENCES

### GROWTH OF SHANGHAI ELECTRONICS INDUSTRY DETAILED

Shanghai WEN HUI BAO in Chinese 19 Sep 79 p 1

[Article: "Ambition and Courage Bear Extraordinary Fruit Over the Past 30 Years; From Nothing to Something, the Shanghai Electronics Industry Prospers; There Are More Than 200 Plants With More Than 100,000 Workers Engaged in The Manufacture of Electronic Products; A Science and Technology Troop Has Been Formed"]

[Text] Ten years ago, the city was able to manufacture only about 1,000 14-inch black and white television sets per year. Today, the city is capable of manufacturing not only five different types--9, 12, 14, 16 and 19 inch--of black and white television sets but also 19 inch color television sets at more than twice the 1969 annual output. This is a small picture of the development of Shanghai's electronic industry. In the 30 years since the establishment of the nation, Shanghai's electronics industry has progressed from nothing to something, from small to big, from inferior to superior quality; and it continues progress toward a higher, better and more advanced level of achievement. It has made a positive contribution to socialist construction.

The electronics industry is a new industry which was developed in the 1940s. The Old China was unable to make even a single most ordinary electron tube, and all radios were imported. In the early days after liberation, there were only a handful of radio repair shops in Shanghai. Since 1958, some textile and light industry workers who have never had any experience in electronics overcame superstition, and by liberating ideas and unfolding the revolutionary spirit which is characterized by daring to think and act, they started an electronics industry in the old workshop, with old equipment. They manufactured simple parts. The workers from a magnetic materials plant developed magnetic steel which was urgently needed for the development of the electronic industry. They used a stone roller found in the drugstore. Some 10 workers from the Shanghai Electron Tube Plant and students from the middle school and college got together and manufactured the first electron tube made in this country using scissors and sewing needles as tools. The Shanghai Broadcasting Materials Plant manufactured the first television set. A group of semiconductor plants,

electron tube plants and radio plants have since appeared, presenting new and prosperous circumstances for the electronics industry. Today, there are more than 200 plants dealing in electronics products with more than 100,000 workers including more than 5,000 technical personnel. A troop of science and technology workers has thus been formed. The variety of electronics products has also progressed very rapidly. According to the statistics compiled by the city instrument bureau, 1,680 electronic parts and assemblies were manufactured in Shanghai in 1978. From 1965 to 1978, a 5.5 fold increase in the production of electronic parts and an 8 fold increase in the production of radios was achieved. The total number of television sets manufactured in Shanghai in 1978 was more than 20 times that of 1972. The city has further successfully trial manufactured an integrated circuit for a computer which is capable of performing 1 million computations per second, a small scale multifunction electronic computer, a radio telephone, various medium and large scale integrated circuits, a color television rebroadcasting trailer, a color television projector, color television mirror [5152 6975], video recorder and magnetic discs and tapes for the electronic computers.

During the Great Cultural Revolution, Shanghai's electronics industry suffered a great blow and the gap between its standard and the world's advanced standard was widened thanks to the interference and destruction wrought by Lin Biao and the "gang of four." At that time, besides the city instrument bureau, there were many electronic parts and assemblies plants, from manual labor to light industry, with overlapping products and a scattered production force. Since the "gang of four" was smashed, the concerned city government department has strengthened its leadership of the electronics industry and has taken timely and appropriate measures. Since September 1977, more than 80 plants belonging to the light industry bureau and the manual labor bureau employing more than 37,000 workers and manufacturing various electronic parts and assemblies have been reassigned under the unified management of the instrument bureau. The city instrument bureau carried out reform and reorganization according to the principle of cooperation of the specializations, combining the entire electronics enterprises with thought of specialization. As a result, the television industry company, electronic computer industry company and semiconductor equipment industry company have each been organized, and every electronics enterprise has been assigned according to its specialization to one of these specialization companies to achieve unified management. This has helped to quicken the pace of development of the electronics industry. Since specialized production was adopted by the television industry company, the company owns five television assembly plants--Shanghai Radio No 18 Plant, Television No 1 Plant, People's Radio Plant, Shanghai Radio No 32 Plant and Television No 11 Plant--and a number of plants manufacturing specialized electronic parts. The production of television sets has since increased significantly. The total number of television sets manufactured in 1978 was more than 206,000 which was more than the total number of television sets manufactured in 1975 and 1976 combined. The quality of the television sets has also been significantly improved while the cost has gone down.

The vast majority of the workers and the technical personnel at Shanghai's electronics enterprises have ambitiously and courageously pledged to struggle for the development of the electronics industry and to catch up with and even surpass the world's advanced standard. The TTL integrated circuit manufactured by the Shanghai Radio No 19 Plant is especially developed to be used with various large, medium and small scale electronic computers. In the past, the units manufacturing electronic computers had to put together a set of the necessary electric circuits from various plants by making the parts in order to be able to assemble the computer. It was a process which not only consumed large amounts of time and labor but also encountered much difficulty on account of the different specifications of parts manufactured by different plants. As a result, the quality of the assembled machine was poor. A decision was made in the latter half of last year that the plant was to design and trial manufacture a series of medium-scale integrated circuits as a gift to the nation on the 30th anniversary of its National Day. Many difficulties were encountered during the process of the trial manufacture, but the progress was swift thanks to the vast majority of workers and technical personnel who launched an all-out assault on the pivotal point. After 10 months of struggle, they have finally been successful in the trial manufacture of a set of 40 medium-speed, medium-scale digital integrated circuits. They have thus created favorable conditions for the development of manufacturing a domestic electronic computer which would be smaller in size, have a higher speed and greater reliability.

Following the step-by-step improvement in the people's cultural as well as material life, the people are making more and more demands on electronic products such as televisions, radios, recorders and phonographs. The vast majority of the workers at Shanghai's electronics enterprises are doing everything they can to increase the production of the electronic products. The Shanghai Radio No 18 Plant originally manufactured amplifiers. It began the trial manufacture of television sets in 1972. The plant's workers and the technical personnel designed and constructed an assembly line which is capable of producing one 12 inch television set every 2 minutes, with an annual production capability of 60,000 sets. The plant can manufacture 9, 12 and 19 inch black and white television sets. Its production goal for this year is 186,000 television sets. The plant has rapidly become one of the most productive television plants in the country. The electronic equipment industry company is actively renewing and changing radio production according to the market's sales record. They have trial manufactured a number of radio receivers including the Hongdeng (Red Light) brand, model 753 small transistor radio; the Chunrui (Spring Thunder) brand, model 3T9, 12 tube 3-band radio receiver; and the Haiyen (Petrel) brand, model T241, 14 tube 4-band receiver. These products have been well received by the consumers. Some of the plants belonging to the company, including Shanghai Radio No 3 Plant, Shanghai Radio No 2 Plant, Shanghai Recording Material Plant and the No 101 Plant, are actively engaged in the trial manufacture of a box-type recorder. The Shanghai Radio No 3 Plant has trial manufactured more than 8,500 sets of

recorders this year. These recorders are to be put on the market on the eve of the 30th anniversary of the National Day. From January through August, the company manufactured more than 45,000 sets of recorders, which was three times the total production of 1971.

In preparation for the celebration of the 30th anniversary of the National Day, the vast majority of Shanghai's electronics enterprises are more than ever determined to develop and raise the standard of the electronics industry rapidly; to march forward in the modernization of electronic science and technology, the automation of its production and the scientification of its management; to make Shanghai a strong base of the electronics industry where soldiers and people are united, categories are complete, varieties are matched and the technical standard is high; and to supply even more electronics products for the modernization of the national economy and to improve the people's lives.

9113

CSO: 4008

## APPLIED SCIENCES

### NEW MATERIAL FOR COMMUNICATIONS APPLICATION INTRODUCED

Shanghai WEN HUI BAO in Chinese 11 Aug 79 p 1

[Article by Zhang Zonghao [4545 1350 2507]: "A New Optical Fiber Has Been Successfully Manufactured by the Silicate Institute and Other Units"]

[Text] The Shanghai Silicate Chemistry Technology Institute, Chinese Academy of Sciences, with the assistance of Shanghai Optical Fiber Communications Battle Front, has successfully developed one of the important media of transmission used in the modern communications--a multimode, gradient type optical fiber of silicon-phosphorus family--and passed the authentication inspection.

Optical fiber communication is a method of transmitting information through an optical fiber by means of laser beam. It can be used to transmit words, letters, data and drawings. The optical fiber developed by the institute possesses various properties including transmission loss, transmission band width and tensile strength surpassing the advanced domestic standard. Some of the indices are even approaching the advanced international standard. It can be used for the medium range optical fiber communication employing short wave, low loss, broad frequency band.

The Shanghai Silicon Institute has been conducting optical fiber research since 1974. In 1976, it conducted, in cooperation with the Fourth Ministry of Machine Building, Ministry of Posts and Telecommunications and the Structure of Matter Institute of Chinese Academy of Sciences, an experiment of simultaneous transmission of 24 channels including telephone, visible telephone, black and white television, and color television over an optical fiber kilometer long. Last year, the National Science Conference and the Chinese Academy of Sciences presented written citations to the concerned institute for this achievement. In 1978, the department handling the preparation and technology of the multimode, gradient type silicon-phosphorus optical fiber was transferred to the Shanghai Xinhua Glass Plant in order to continue the intermediate stage expanded experimental work. The necessary optical fiber for the experiment carried out by the Shanghai Optical Fiber Communications Battle Front will be supplied by this glass plant. The Silicate Institute, thus, began its second stage research activities on

this foundation. After a year's struggle, a more complete analytical and measuring method for the optical fiber research has been established and the performance of optical fiber enjoyed new progress.

The Chinese Academy of Sciences has recently sponsored a meeting for authentication of "multimode, gradient type silicon-phosphorus optical fiber." Those present, representing the National Science Commission, Ministry of Posts and Telecommunications, Fourth Ministry of Machine Building, Second Ministry of Machine Building and various other production and scientific research units, believe that the "multimode, gradient type silicon-phosphorus optical fiber" is one of the important domestic original scientific achievements which occupy the leading position, and that it has contributed significantly to the development of this country's modern communications industry.

9113

CSO: 4008

## APPLIED SCIENCES

### GROUP OF ELECTRONIC COMPUTER FANS DESCRIBED

Shanghai WEN HUI BAO in Chinese 22 Aug 79 p 1

[Article by Shen Ding [3088 1353]: "Run, Computer Run!"]

[Text] Spring is often used as a symbol of life. When an able physician revives a person from death, don't people speak of a "skill which returned spring"?

We met a "doctor" at the Ruijin Hospital belonging to the Shanghai No 2 Medical School. He asks his patient various questions such as sex, age and the symptoms such as temperature, if they are coughing blood, have chest pains, etc. One question, one answer. After a series of 36 questions are answered one after another, a diagnosis is quickly made. This highly competent "doctor" is not one of those soldiers in a white gown whom we see often, but an electronic computer.

In another room, we saw an outstanding "accountant" who typed out row after row of numbers at lightening speed. It entered onto a form the medical fee, the diagnostic fee, the examination fee, the transfusion fee, etc. of each patient according to the unit and the one bill number after another in an orderly manner. This is not the ordinary abacus-wielding accountant we know so well but an electronic computer.

Those comrades who are familiar with computers know that the JS-10A computer is one of the "less efficient" computers in the huge family of computers. Yet, it displays such superhuman abilities in the hospital. Who made it into a doctor or an accountant, after all? You may not believe it, but most of the software work, except for the assistance rendered by the Ruijin Hospital and the Shanghai Instrument Plant, has been accomplished by a group of unknown youths--a group of amateur electronic computer fans.

There are amateur writers, amateur actors, amateur sportsmen; is it true then there are amateur electronic computer workers, too? If you want to know their story, you must begin with their teacher--Xu Xiaoxing [1776 2556 2502] of the Shanghai Assembly Automation Institute.

## The Attraction of Computers

Xu Xiaoxing, a graduate of Survey and Draft College, was a complete outsider in electronic computers. In 1973, Huang Tongnian [7806 3392 1628] of the Chengdu Tool Institute invented a technique for measuring the total error of gears. The technique was considered comparable with the world's advanced standard. Later on, the First Ministry of Machine Building assigned a task of developing an electronic computer program to handle the data related to the gear error analysis, so that an advanced measurement technique could be fitted with a modernized computational tool. This task was tackled jointly by the Chengdu Tool Institute, the Shanghai Industrial Instrument and Automation Institute and the Shanghai Teacher's College using the facilities at the Shanghai Measurement and Cutting Tools Plant. Xu Xiaoxing was a technician at the measurement and cutting tools plant. The plant leader assigned him to participate in this technical battle in order to cultivate young Xu and to allow him to acquire experience in some modern technique. Since then, this outsider has established an unbreakable bond with the electronic computer.

Where there is an ideal, there is power. Xu Xiaoxing began a new, tense life of learning. He went out and bought every book about electronic computers he could find and started to study them in earnest one after another. When comrades from the teacher's college and the automation institute were discussing their work and arranging the program, he would listen attentively and put in his notebook all the diagrams drawn by others whether the program worked or failed, and then he would study and polish them section by section. In those days, his head was filled with symbols, commands and other computer notations, when he was walking, eating or sleeping. Even when his wife had a baby he was too busy to take care of them. Within a year or so, he memorized everything contained in his 30 notebooks, amounting to approximately 1 million words. Under the sponsorship of the Shanghai Science Association, he undertook the task of compiling a reference manual of 100,000 words entitled "Basic Program Design for JS-10A Computer." The manual was recognized by his colleagues as a tool that will contribute significantly to popularization of this type of small scale electronic computers. At this point, Xu Xiaoxing discovered that his originally near-sighted eyes had worsened 100 percent as a result of working under a lamp night after night.

The electronic computer, like magnet, has completely captured Xu Xiaoxing's heart, like many other people's hearts. By October 1975, the task of fitting an electronic computer to the gear testing and measurement instrument had been completed by the joint effort of the units concerned, and the product was put on display at the Shanghai Electronic Technology Exhibition. The plant put Xu Xiaoxing in charge at the exhibition to explain and demonstrate the computer. In the same exhibition hall, an automatic nut packaging machine was on display by the Shanghai No 5 Nut Plant. The narrator was a young worker Qian Cangren [6929 2490 0088], who was also the principal inventor of this machine. Soon, little Qian

and Xu Xiaoxing became acquainted. Little Qian was a high school graduate, class of '66, and possessed a good background in electronics and mechanical technology, thanks to his eagerness to learn. He had 1 year of education at the Fudan University studying the electronic computer. Nevertheless, he was still quite ignorant about the computer's software. Therefore, he begged Xiaoxing to teach him about it, which he did. Every day, early in the morning, before the spectators were admitted into the hall, they huddled over the electronic computer. In the evening, they remained long after everyone had left. First of all, Xu Xiaoxing taught Qian Cangren the sing-song program, then the play-flower program.

One day, while the computer was playing a pleasant melody without missing a beat, according to the programmed sequence, or drawing frame after frame of beautiful drawings and patterns, two young spectators who, charmed by the melody of the music and the pattern of the beautiful picture, lingered. "How does an electronic computer work?", asked the young men with sincere curiosity. Xu Xiaoxing explained it to them passionately. They then timidly asked: "Can you tell us where to begin, if we were interested in learning something about electronic computers?" Seeing these young men so eager to learn, Xu Xiaoxing was very delighted. "If you are willing to learn, I can teach you, but I must charge you tuition." "Tuition?" "Yes, the tuition is the resoluteness." The two young men said excitedly: "This tuition we can pay!" So, Xu Xiaoxing accepted these two young men as his students. They were graduates of Xincheng Middle School, class of '73, and were classmates. One was called Yang Jing, who was serving his apprenticeship at a cake and fritter shop; the other was called Sun Zhonglin, who was resting at home because of asthma.

These two young men's zeal to learn was no less than that of Xu Xiaoxing's to teach. To provide breakfast for many people, Yang Jing must report to work at the shop at 3 AM. He would start to study about the electronic computer as soon as he was off duty at noon and continued to study late into the night, often as late as 1 or 2 AM, so that he would often go back to work without sleeping a wink. As for Sun Zhonglin, his study was interrupted by his illness, but he kept at it at home, reading books and finishing exercises assigned by his teacher Xu.

They used their spare time to learn, and Xu Xiaoxing used his spare time to teach, regretting that he could not transmit all he knew to them all at once. He knew that the electronic computer is a symbol of modernization and the direction in which to develop. One more person who has grasped it means one more part of strength.

#### Many Comrades Are on the New Road of The Long March

"The world is full of acquaintances, yet few are really good friends," was the lament of an ancient people. However, people like Xu Xiaoxing, who looked for the secret of electronic computers, have many good friends. Xu Xiaoxing befriended a group of computer lovers. Most of them are youths, younger than 30. Besides Qian Cangren, Yang Jing and Sun Zhonglin, there

are Wang Dejian of the No 2 Concrete Product Plant, Liu Xiaoxing of the Wujing Chemical Plant, Zhang Jinliang and Jin Heliang of the Shanghai Regulator Plant, Fan Changhong of the Yongjia Plastic Factory and Tan Zehua of the Shanghai Calculator and Typewriter Plant. Some of them were more familiar with the electronic elements and circuits and some with software and programming. Together, they can talk shop endlessly.

An electronic computer consists of hardware and software. The hardware is the computer itself and its peripheral equipments. The software is the method of operating the computer, or more commonly known as the program or command. How is it that the same computer can automatically control a group of machines in a factory while making a diagnosis in a hospital? The differences lie in their software. Great importance is attached to the software work abroad, and the number of people in software far exceeds the number of people in hardware. The standard of our electronic computer is quite backward; it is especially weak in the software department. Many units do not know how to operate the computer after they get one. Take the small JS-10A electronic computer manufactured by the Shanghai Regulator Plant, for example. According to an investigation carried out by Xu Xiaoxing, only approximately one-third of these electronic computers owned by various units all over the city are being used regularly. Approximately one-third of the computers are in need of repair, and the other one-third cannot be operated only because the software problem has not yet been solved. Xu Xiaoxing and his friends discussed this matter, and they felt that they must do their part in spreading and popularizing the electronic computer. They were all delighted to call a place where they could exchange experiences a "Civil Exchange Station."

Don't look down on this "Civil Exchange Station." It has actually solved the problem to some extent already. After the exhibition ended, the measurement and cutting tool plant was visited by many other units which had been attracted by its fame; they sought help on their small computer programming problems. Xu Xiaoxing has never refused a request for help, for he well understands the urgent needs of others. When he was too busy to take care of these problems personally, he would ask the regular members of the "Civil Exchange Station" to help. Everyone worked together. In this way, they have, so far, helped to solve problems for the First Ministry of Machine Building in testing the field data, for the Nanjing Hydrology Science Institute in the treatment of harbor wave data and for the Guangzhou No 19 Plastic Plant in the digital control of the injection molding machine. With everyone's assistance, Xu Xiaoxing has further compiled more than 10 reference manuals including, for example, "D7B Printout Programming Procedure," "BY75 Computation Programming Procedure," "SKY Digitally Controlled Language," "Computer Audio Display Device," "Phrase Programming Code Method" and "High-Speed Fourier Analysis Procedure." These manuals have been very well received by their users. A manual entitled "Design Method for Hand Programming," coauthored with Yang Jing, was published by the information section of the Machinery and Electricity First Bureau. The entire 3,000 copies of the manual were bought up by brother units in no time.

Each member of this "Civil Exchange Station" has his own specialty. Some specialize in the software while others in the hardware, including such peripheral equipment as typewriters, photoelectric devices and hole punchers. For some years, they have met once or twice a week, to learn about or to discuss a specific problem. In their own words, what they are doing is "amateur research and civil exchange." When a plan has been decided upon, one or two comrades will be assigned to carry out the design work and the progress will be reported to the group at their next regular meeting. If difficulties are encountered, everyone puts his head together in order to solve the problem. Over the years, they have prepared a card file for the several hundred JS-10A computers scattered all over the country. The cards contain the date of manufacture, its present application, working condition, etc. As for the computers used in the Shanghai metropolitan area, they are as familiar with them as their own hand. Even comrades from the regulator plant which manufacture this type of computer cannot help but praise such a detailed data file.

Good news travels far. Many units both in and outside the city and these young men who love to learn are familiar with Xu Xiaoxing and his friends who have studied JS-10A computer extensively, and many have actually paid visits in order to learn from them. The front yard of Xu Xiaoxing's home is regularly packed with bicycles. His 12 square meters attic room is regularly packed with people; either he is giving a lesson to the young people or he is receiving guests from far away. Once, he received simultaneously many guests from Xinjiang Physics Institute, the Nanjing Hydrology Institute and the Beijing Automation Institute. One of the guests intimately addressed the Old Xu and his friends as the "friends of the computer."

#### Noble Purposes

From the events described above, the reader can see how these "computer fans" got together in the first place. What really brought them together? Let us go back to the Ruijin Hospital for a moment.

It was the Spring Festival of 1978. Like any ordinary holiday, Yang Jing and Sun Zhonglin went to visit their teacher Xu Xiaoxing. As soon as they stepped inside they saw Xu Xiaoxing lying on the bed surrounded by computer books, his nostrils were plugged with two balls of cotton.

Xu Xiaoxing was delighted to see Yang Jing and Sun Zhonglin. He told them that the Ruijin Hospital was undertaking the modernization of medical care and wanted to apply the electronic computer technology to this work. He wanted to discuss the block diagram of the computer program with them.

As they were discussing, Xu Xiaoxing's nose started to bleed again and the cotton balls fell off. Little Yang and little Sun hastily brought fresh cotton balls and helped plug his nostrils. But the blood poured out of his mouth. Seeing this, little Yang and little Sun suggested: "Let's discuss this next time." Xu Xiaoxing said: "No, the hospital is in such urgent need of modernization now. How could we delay!" They continued their discussion which lasted a full 4 hours.

According to Xu Xiaoxing's plan, the electronic computer of Ruijin Hospital will be fitted with a control desk. This way, one can avoid the need to choose between a binary system and an octal system and allows direct conversation between people and machine. He let Wang Dejian design the electric circuit. At the time, Wang Dejian was in the midst of preparing for an examination to become a graduate student. When he understood how much effect such a control desk could bring to so many units, he decisively put down his books and spent all his spare time in the library and the information office, gathering data. Then worked late into the night daily for more than a week to finish the general draft. This was the original design of the model JSK-I control desk which is being used today by so many units. During the process of testing and adjusting the machine at the Ruijin Hospital, Comrades Yang Jing, Qian Cangren, Tan Zehua and Pan Changhong were at the hospital every day after work making connections and running tests. Many times, they worked until 1 and 2 AM, or even throughout the night. One evening, half way through the program a mechanical failure occurred. So, they sent for Zhang Jinlian to repair it. But, Zhang Jinlian's wife suddenly fell ill and he was then preparing to bring her in for an emergency sick call. When he understood how the electronic computer failed, he rushed to the hospital to repair the machine; he could not attend to his wife's illness. The comrades at the hospital, upon learning about the situation, brought her in for emergency treatment.

Use of an electronic computer for diagnostic and accounting purposes at the Ruijin Hospital is still in an experimental stage. However, we see a brilliant tomorrow for the Four Modernizations of our motherland, thanks to this group of "electronic computer fans."

9113

CSO: 4008

## APPLIED SCIENCES

### NEW ACHIEVEMENTS IN RESEARCH ON APPLIED DYNAMICS

Beijing GUANGMING RIBAO in Chinese 11 Oct 79 p 2

[Text] According to this newspaper, Liu Renhuai [0491 0086 2037], lecturer at the China Department of Modern Mechanics University of Sciences and Technology has obtained new results in the past two years in the study of plate and shell theory in elasticity mechanics.

The important result by Liu is in establishing the corrugated circular plate characteristic equations. The corrugated circular plate is a kind of circular thin plate manufactured from beryllium bronze, nickel and silver, upon which is pressed concentric corrugation, widely used in the meters of delicate instruments in industries like aeronautics, astronautics, navigation, atomic energy, meteorology, petroleum refinery and is one of the essential components. It is equivalent to the human sensory organ such as the eye or ear which can sensitively feel environmental changes such as force, volume of flow and speed, emit signals, and is controlled by monitoring system. Because of the complicated shapes of the corrugated circular plate and difficulties in nonlinear mathematics, recently only scientists from a few countries are involved in the theoretical studies of corrugated circular plates internationally and their studies are inadequate. Liu adopted the "modified iterative method" which he collaborated with Professor Ye Kaiyuan [0673 7030 3293] while at Lanzhou University found similar analytical expressions. Compared to formulae found abroad, they have higher degree of accuracy and a wide scope of application. Concerning the circular plate with a smooth center and non-sinusoidal corrugation, no theoretical formulae have been found abroad. The expressions found by Liu fill in the theoretical gap. His two scholarly papers on "The Characteristic Expressions of Corrugated Circular Plate," and "The Characteristic Expressions of Corrugated Circular Plate with a smooth Center," were highly praised at the fifth National Academic Conference On Elastic Parts in the latter part of December 1979 and were recognized to have reached international standard. Achievements in these two categories will not only change the Chinese position of backwardness in this area and will have positive effects in the saving of capital and materials and trial production of new products, but will have important guidance implication in the development of this technological area.

Liu's scientific research achievements also include three other items:

1. He solved the curvature problem in thick tubeplate. High pressure immobile heat exchangers are widely used in industries such as chemical engineering, petroleum, food, dynamics, and atomic energy. One of the key components is tubeplate structure. During the recent 30 years or so, research abroad in thin tubeplate theory of immobile heat exchanger of medium and low pressure is highly emphasized but the research in the theory of the more difficult and even more important high pressure thick tubeplate is hardly touched upon. Until recently, the world has only applied the theoretical formulae obtained from low pressure and medium pressure thin tubeplate to the design of high pressure thick tubeplate, and this obviously is not rational. Liu found the accurate theoretical formulae for thick tubeplate. His contribution will result in the saving of capital and steel material.

2. He established theoretical expressions for heat stability. A shell of truncated shallow conical shape made from two metallic layers of different coefficients of thermal expansion, used in automatic meter system, can sensitively detect the environmental temperature changes, and thus supplies the necessary control signal. Liu overcame the difficulty in nonlinear mathematics and found theoretical expressions for this problem. This achievement gives direction to meter system design.

3. He derived nonlinear curvature theoretical expressions of sandwiched circular plate. Sandwiched plate is composed of 3 layers; the lower and upper are thin layers of strong material and the middle layer is light and soft thick sandwiched core. It is widely used in industries like aeronautics, astronautical, and shipbuilding. Because of the complicated structure of sandwiched plate and difficulty in solving nonlinear mathematics, worldwide researches in sandwiched plate are rare. Liu derived the theoretical expressions for the nonlinear axial symmetric curvature of sandwiched circular plate under the effect of the edge moment, and adopted a unique solution, and thus found an accurate solution to this problem.

Even in his student days, Liu had observed trends in this area. After graduation, he began to collect material for his research topic. In the period of "the gang of four," Liu was denigrated to do farm work, but he has never stopped his research. In 1972 he completed his work on "The Characteristic Expressions for Corrugated Circular Plate," but could not have it published. After the defeat of "the gang of four," his research work was published in the first issue of LIXUE XUEBAO [Acta Mechanica Sinica] in 1978.

9515

CSO: 4008

## APPLIED SCIENCES

### JOINT EXAMINATIONS OF TELEVISION SETS CONDUCTED BY THREE DEPARTMENTS

Shanghai JIEFANG RIBAO in Chinese 1 Sep 79 p 1

[Article by Sun Lin (1321 2651): "Reporting Examination of Black and White Television Sets by the Shanghai Instrument Bureau"]

[Text] In the past several days, the black and white television sets manufactured by six plants belonging to the Shanghai Instrumental and Telegraphic Industry Bureau have been undergoing a strict examination by the "three courts" consisting of the bureau (the instrument bureau), the company (the television company and the electronic equipment company) and the commercial department (the communications and telegraph station and the city hardware and communications and telegraph company).

The "examinees" are 845 television sets representing 13 models manufactured during the month of August. These sets are 9 inch, 12 inch, 16 inch and 19 inch screen television sets together with independent elements and integrated circuit construction. The chief examiners consist of comrades from various commercial departments including the Hardware, Communications and Telegraph Company and the Fuiyao Television Store. The examination is aimed not only at the general quality of production but also at conducting a random inspection of the sets manufactured during August. In the past, the sets which were presented for examination were generally "prepared for the occasion." This time, the sets to be examined are chosen at random directly from the production line by the examiner and the plants are not forewarned.

On the 28th of last month, the mechanical laboratory of the Shanghai Radio No 2 Plant was crowded with the people who came to witness an examination of the mechanical performance of 39 television sets representing 13 models. Each set, still in its original box, was first tested on a shaker at frequencies of 20, 30, 40 and 50 cycles per second with a maximum amplitude of 1.25 millimeters; next it was subjected to an impact test in which the package was hit 300 times. The box was then opened and the set removed. The "naked" set was then dropped 10 times from a height of 5 centimeters. Then the set was examined by the members of the examination committee. After the repeated shaking and pounding, the mechanical performances of various models were made public. Some of them passed the examination

unscathed, revealing their true colors of a hero; some were shaken loose, or worse, became inoperative. The examiner carefully noted all the problems which arose, and the representatives of the plant took down the problems found on their sets for further study and in order to chart the course of future improvement.

The mechanical performance test tries to simulate the vibrations, impacts and dropping that these sets may experience during transportation; but, it is not the actual transportation. Before this examination was carried out, another group of 130 television sets were loaded on three trucks which made a round trip between Shanghai and Hangzhou, a total distance of 480 kilometers. Between these two points, the trucks twice traveled over more than 100 kilometers of relatively rough road between Haiyan and Qiaosi. The majority of the television sets subjected to the actual transportation test were found by the scrutiny of the members of examination committee to be undamaged, thus passing the examination 100 percent.

While a portion of the "examinees" were subjected to vibrations, impacts, dropping and transportation tests, others were subjected to a severe test of high temperatures at the Shanghai Radio No 18 Plant; they were exposed to a high temperature of 40°C for 196 hours. Several hundred sets crowded into the room were turned on continuously with a 30 minute rest period every 3 hours. The examiners watched through a glass window and noted the number of sets which failed to function properly. The first batch of 329 television sets representing seven models were tested continuously at high temperatures for 8 days and 8 nights plus 4 hours since 16th of August. The result was that more than 90 percent of the sets maintained a good performance. The average trouble-free working time was 2,400 hours for the best and 790 hours for the worst. A second batch of 282 television sets representing six models are being tested now.

These examinations are still going on today, and who the "rank scholar" is has yet to be determined. However, the members of the examination committee told this reporter: "The purpose of this examination is not to find out which is number one, but rather to reveal the discrepancies so that we may organize the battle to improve the quality of the television sets." Shanghai's television industry was launched hastily without a very firm foundation, so many problems related to the quality of its products remain. The reorganization carried out over the past year or so did improve the quality significantly. However, this general inspection has exposed many weak spots, also. For example, after the vibration, impact and dropping tests, more than half of the sets tested developed some problems, large or small. The high temperature test proved that a portion of the sets were unable to meet the minimum standard of 1,000 hours of continuous operation. We hope that the quality of television sets manufactured by the various plants will be improved significantly as a result of this examination.

**"Jinxing" (Venus) Brand Television Sets Enter the Advanced Rank of Domestic Television Sets**

The Shanghai Television No 1 Plant was previously known as Jinxing Fountain Pen Plant. In order to meet the need to develop a television industry, various difficulties were overcome such as shortage of equipment and adverse conditions and every favorable condition of the old enterprise was fully utilized. Importance has been attached to quality and it has struggled to open up new roads. This year, it finally achieved its goal by winning a seat in the ranks of the advanced domestic level for the "Jinxing" brand, 12 inch black and white television set, by winning the second place.

9113

CSO: 4008

## APPLIED SCIENCES

### SCIENTIFIC, TECHNOLOGICAL COMMISSION AWARDS MAJOR INVENTORS

OW121610 Beijing XINHUA in English 1500 GMT 12 Oct 79 OW

[Text] Beijing, 12 Oct (XINHUA)--Fifteen major inventions or discoveries have been given awards ranging from second to fourth class by the Recommendation and Examination Committee of the State Scientific and Technological Commission at a recent meeting here.

Recipients of second class awards were: Xie Desheng and his colleagues in the Sichuan Oil Administration for their new method of producing sodium n-octadecylterephthalamate and sodium of n-mixed-alkylterephthalamate--a new class of oil-gelling agent, and lubricating grease; inventors in the Shengli oil field for an artificial diamond drilling bit; the researchers of Qinghaosu--a new anti-malaria medicine; and Zhang Dehua and his colleagues for their invention of 71-model worm gears at the Capital Iron and Steel Company.

Recipients of third class awards were: Zheng Xingzhai and his colleagues at the Shengli oil field for their invention of a SDC--model 3 curving digit-converter, Guan Jingjie and his colleagues at the Institute of Petro-Chemical Science for their new washing process to improve activity and stability for "Pian-Y" zeolite catalyst, Wang Qixiang and his colleagues at the Beijing Chemical Engineering Institute for their invention of a tumbler centrifuge; Wang Wenxiang and his colleagues at Zhengzhou University for new invention for a spherical catalyst in ammonia synthesis; Wang Yuxian and his colleagues at the Ministry of Geology for their invention of a GJF--1 model high frequency dielectrical separator and a separating method; Ding Yuanchen and Wang Lianjie at the Ministry of Geology for their invention of a CW-250 model transducer pressure calibrator; Guo Mugun and his colleagues for their invention of a pneumatically controlled multi-stage fluidized bed and its application in waste gas purification; inventor Nie Ruilin at the Kunming Botany Institute for his discovery of a new plant C.C.A., which contains insect moulting hormone; and engineers in Hubei for a Hubei--12 model boat tractor.

There was one fourth class award given to inventors of a new process for development of chemical mulch--an agent for increasing the temperature of soil.

BRIEFS

NEW COMPUTER--Beijing, 8 Oct--A young acoustics researcher has made a small electronic computer respond to his spoken orders. He is Yu Tiecheng, an assistant research fellow at the Institute of Acoustics under the Chinese Academy of Sciences. The computer recognized over one hundred oral commands and does addition, subtraction, multiplication and division, and solves equations following oral commands. Yu Tiecheng has given more than one hundred demonstrations with the machine, including some for foreign acoustics specialists. Direct dialogue through language between man and machine is important for China, where it is planned to make greater use of automation. The results of Yu's work can be applied to sorting mail, inspecting products, numerical control machines, information retrieval, space technology, directing manipulators and robots and voice-controlled locks. [Text] [Beijing XINHUA in English 1201 GMT 8 Oct 79 OW]

TIBETAN LANGUAGE TYPEWRITER--Lhasa, 16 Oct--Wang Shizhen, a Tibetan translator, has been awarded a certificate of merit and a bonus by the scientific and technological commission of the Tibetan Autonomous Region for producing a new typewriter for the Tibetan language. Formerly the typewriters used for Tibetan were of the case type. The new kind has a keyboard and is far easier to use. It only takes one week for a beginner to become familiar with the keyboard and one month's training will enable him to type 2,500 Tibetan syllables per hour. The speed is three times that on the case type typewriter. Wang Shizhen is a Tibetan translator for THE TIBETAN DAILY. In designing the new typewriter, he made repeated studies of the structure of the Tibetan language and consulted people in Gansu, Beijing, Xianyang and Lhasa. He has worked in cooperation with the Central Nationalities Publishing House and Shanghai Computer and Typewriter Plant. Keyboard Tibetan typewriters are now in production in Shanghai. [Text] [Beijing XINHUA in English 1203 GMT 16 Oct 79 OW]

BIMONTHLY MAGAZINE TO BECOME MONTHLY--JIANCHUAN ZHISHI has announced that effective the second half of 1980, the publication will become a monthly. It will remain a bimonthly magazine during the first half of 1980, appearing every even month. The price of each issue will be 0.20 yuan. Beginning 1980, this magazine will be officially distributed abroad by the China International Bookstore [Zhongguo Guoji Shudian]. [Excerpt] [Beijing JIANCHUAN ZHISHI [Knowledge of Ships] in Chinese No 5, Oct 79 p 35]

## SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

### WORK RECORD OF TROPICAL DISEASES SPECIALIST REPORTED

Beijing BEIJING RIBAO in Chinese 9 Nov 79 pp 1-2

[Article by Chen Xuhao [7115 4872 6275] "Pursuing Scientific Research With One Heart and Mind; Going Everywhere For the People--A Record of the Life and Work of Tropical Diseases Specialist Zhong Huilan [6945 1920 3482]" ]

[Text] It is late at night. In one of the offices of the Beijing Tropical Medicine Institute, an old professor is still leaning over his desk writing a book. He is the director of the institute, member of the Department of Biological Sciences of the Chinese Academy of Sciences, the noted tropical disease specialist Zhong Huilan [6945 1920 3482].

Professor Zhong has been engaged in medical research for over 50 years. He has contributed richly towards the clinical research, theoretical research and epidemiology of black fever, pulmonary distomiasis, hepatic distomiasis, leptospirosis, relapsing fever, typhus, and malaria. He has published 333 research papers and contributed greatly towards the motherland's medical science research. Now Professor Zhong is already 78 years old but he is still going strong and is still full of spirit and guarding his own work post.

1. Zhong Huilan spent his youth in poverty. In his early years, his father, out of necessity, sold himself to the rich in Southeast Asia. On June 24, 1901, Zhong Huilan was born on the island of Reli, then Portuguese East Timor. At the age of 6 he lost his father. His family was poor. When he was 13 years old, he went to school in East Timor. But Zhong Huilan thought of his motherland. In spring of 1917, he finally found a chance to return to the motherland and went to a middle school in Canton to study. Then, he passed the entrance exam and was admitted to the Beijing Xiehe Medical College. At that time he was poor and had to work his way through school. But he was conscientious and did well. In 1929, he graduated with a medical doctor's degree and remained at the college to work.

Although life was difficult for the young Zhong Huilan, he was determined to follow the footsteps of French microbiologist and chemist Pasteur and explore the secrets of science. As early as 1927, while Zhong Huilan was still studying in college, he discovered four types of Anopheles mosquitos that

caused malaria in the farm villages in Guangdong Province. One of the most dangerous infectious medium *Anopheles minimus* was seen for the first time in the world. His thesis "The *Anopheles Minimus*" captured the attention of the medical profession after its publication.

The secret of exploring tropical diseases involves not only profound knowledge and undaunted efforts but also a noble spirit of self sacrifice. Zhong Huilan was determined to select this noble task. After graduation from college, he began to explore the difficult course of finding ways to conquer tropical diseases in China.

There are many types of tropical diseases and they do not occur only in the tropics. In old China during the days of suffering, many kinds of tropical diseases were rampant. At that time, a kind of tropical disease called the black fever became an epidemic in the 13 northern provinces. The common people described this disease this way: "A big stomach straps to the body. The king of Hell follows closely behind. An acute case lasts 3 months and a chronic case lasts 3 years but usually the victim dies in half a year." To eradicate black fever, Zhong Huilan conducted surveys in the farm villages in northern China. The conditions for conducting his surveys were difficult but he persisted. Once in a village he discovered that as soon as the patients of black fever were completely cured, new victims of black fever were discovered. Where did the pathogens of new victims come from?

After careful observation in the field, Zhong Huilan discovered that this area had many dogs which carried black fever. Were the dogs the hosts of contagious black fever? At the time, some Western scholars believed that China's black fever was the same as that in India and was not related to dogs. Zhong Huilan was not convinced. He rented several rooms in Shansi Province and raised over a dozen dogs infected with black fever. Each room housed one dog. Each evening he opened the windows of the rooms to attract sand flies to test its natural contagions. At night, he got out of bed several times, put on his clothes, got his flash light and inspected each dog. With the support of Professor Feng Lanzhou [7458 5663 3166] he persisted for 3 years and after over 100 experiments, he finally discovered that the percentage of sand flies that were infected by the diseased dogs during the night reached 44.4 percent to 100 percent, averaging an infection rate of 64.4 percent. He also proved that the pathogens of infected sand flies were the same form as those found in infected dogs and patients.

Animal experiments were successful but whether the pathogens of infected dogs would cause the disease in humans was a question that had to be proven by inoculation of the pathogens into human volunteers. Zhong Huilan thought that experimenting in humans was the key and was a serious matter so he thought the experiment should be performed upon himself. But he was affected by black fever when he conducted his experiments and he was immune to the disease and was disqualified as an object of experiment. His assistants also opposed the idea. But Zhong Huilan shrugged and said: In the pursuit of science, self sacrifice was necessary. Zhong Huilan and his wife Dr Li discussed

the matter. Dr Li thought: There are many more things waiting for Zhong Huilan to do and how can he be allowed to take such a risk that would endanger his life? She finally convinced Zhong Huilan to perform the experiment on herself. The pathogen taken from the diseased dog and injected into Dr Li brought about black fever in her as predicted. Zhong Huilan found the pathogens of black fever in her marrow and saw that the pathogens were the same as those in the diseased dog. Zhong Huilan finally negated the theory of the Western scholars with his own independent experiment and new theory, and contributed importantly to the prevention of black fever in our nation.

This was how Zhong Huilan explored the secrets of preventing one tropical disease after another and wrote hundreds of scientific papers on the prevention of tropical diseases. He became known in China and abroad. The Royal Society of Tropical Diseases and Hygienics Society of Great Britain invited him to become a member and the German Tropical Diseases Research Institute also invited him to become a researcher. But in the old society of many evils, scientists with such outstanding achievements like Zhong Huilan did not receive the support from the state and he was unable to fully develop his talent. Zhong Huilan wished very much to change the situation!

2. In 1949, new China was founded. A bright future appeared before the eyes of Zhong Huilan. He was happy about the emergence of a new society which he had wished for for many years. Even though he was already 50 years old, he was still like a young man full of spirit. He plunged himself wholeheartedly into studying tropical diseases. He wanted to use more scientific research achievements to glorify new China.

One day late at night, Premier Zhou invited Zhong Huilan to Beijing Restaurant and tightly held his hand and said warmly: The Party Central Committee has decided to invite you to join the Antibacteria Combat Group of the International Science Commission to go to the northeast and Korea to conduct surveys. What do you think? Zhong Huilan was too excited to speak and could only nod his head repeatedly. This was the great trust and responsibility bestowed upon him by the party and the millions of people of the motherland. No difficulties would ever prevent him from going. On the battlefield Zhong Huilan served as liaison specialist of the international scholars' observation team to investigate bacterial warfare and as deputy director of the bacterial warfare scientific technology group of the Central Epidemic Prevention Commission. He cooperated with Chinese and foreign specialists, completed the mission outstandingly, and received praise from Premier Zhou.

In 1956, Zhong Huilan personally participated in drafting our nation's first 12-year science plan but he did not feel at ease. He said to his colleagues: Since the party and the administration were so concerned about science, our responsibilities were even heavier. We should make our own contributions! He and his colleagues drafted a scientific research plan and decided that the most damaging and most widespread epidemics, pulmonary distomiasis, hepatic distomiasis and leptospirosis should be the major subjects in tropical diseases research.

He came to Hekou and Xishuangbanna in Yunnan Province and in this remote mountain region thousands of li from Beijing, he climbed the mountains, went into lakes and ponds and visited farm families to conduct surveys. The local medical personnel and his assistants all advised him to take care of his health but he always said: "Do not worry, I will not tire myself out." It was here that he discovered the reason why many farmers had pulmonary distomiasis. The local people loved to crush raw crabs into a paste for eating but did not realize that the paste made from raw crabs contained many larvae of lung fluke. After eating it, the people became infected. Professor Zhong Huilan found the cause of the disease from the massive surveys and also summarized some methods of diagnosis and prevention of frequently occurring diseases and reoccurring diseases of this type. The Party Central Committee and the State Council were very interested. Premier Zhou said to Zhong Huilan: It is hoped that you will develop new methods to benefit mankind. This strong utterance became a large stimulative force. Zhong Huilan and his assistants traveled from the border provinces to the inland provinces, from the flat lands to the mountain regions, covering over a hundred thousand li, leaving their foot prints in over 20 provinces and cities. They braved hardships to conduct epidemiological surveys of pulmonary distomiasis and discovered eight new types of lung flukes, wrote over 80 research papers, and developed five or six specific drugs and helped the Science Film Studio shoot a science education film entitled "Prevention of Pulmonary Distomiasis". Their great achievements were awarded and encouraged by the party and government.

After making his achievements in the study of pulmonary distomiasis, Zhong Huilan began to work on new targets! He went to Guangdong Province three times for several years and wrote 42 scientific research papers on leptospirosis. In 1958, a new type of contagious disease simultaneously broke out in several special districts in Sichuan Province. The name of the disease was not known. Some medical specialists thought it might be the plague or a special influenza. Zhong Huilan received orders from the Central Committee to rush to the infected areas and he found pathogens from patients and field rats in the rice fields and correctly diagnosed the disease to be infectious leptospirosis. The people in the infected areas were given the right medicine in time and were saved from suffering. The masses expressed their praise: "Scientific research is done for the worker-peasant-soldier by old specialist Zhong who looked for the disease in watery dampness and picked up crabs and snails and studied them thoroughly. One word spoken by the specialist is worth a thousand jin."

3. As Zhong Huilan was wholeheartedly studying in the wide arena of tropical diseases, disaster fell upon him. At the beginning of the Cultural Revolution, Zhong Huilan was labeled as a "reactionary academic authority" and was sent to a "special political brigade" and locked up inside the "cow shed." He swept gardens every day and hauled manure and fed the animals. He was stripped of the right to conduct scientific research. In 1969, he was allowed to return to his work but the laboratory had already been damaged out of shape. What could be done? He thought painfully whether he should just live on, rest and regain his health and let the days go by? No. He could

not live under socialism and not work for the people. Scientific research must never be abandoned. He struggled with persistence. When a cat died, he quietly took it and practiced dissecting the dead cat. When instruments broke down he fixed them himself. When an infectious disease occurred, he went with his cane to take a look. With the help of assistants Cao Weiji [2580 4850 7221], Gao Peizhi [755 0160 5347], Hu Ruiyun [5170 3843 0061], and Zhang Yueqing [1728 2588 3237], he spent 5 years visiting 10 regions and counties in suburban Beijing and Yunnan and Tianjin, concentrating on surveying hepatic distomiasis and was the first to prove the existence of hepatic distomiasis in the Beijing area.

Zhong Huilan would never forget the moving moment on January 13, 1975 when Premier Zhou who was suffering from serious illness stood in front of the rostrum in the Great Hall of the People and announced to the people of the entire nation the battle cry to pursue the Four Modernizations. Zhong Huilan, member of the People's Political Consultative Conference, looked unmovingly at Premier Zhou and felt excited. He said to himself: Premier, I shall give my life to work for the Four Modernizations in persisting the study of tropical diseases to the end!

The sky cleared. The "gang of four" was finally crushed. Professor Zhong who is now an old man welcomed a new spring in life.

Especially in March, 1978, the Beijing Tropical Medicine Institute which Zhong Huilan wished for for many years was established. Comrade Ye Jianying personally wrote the inscription for the institute. Professor Zhong was named director of the institute. He said happily that he had not foreseen that he would live to see a good era. He led scientific and technical personnel to become self reliant and to struggle hard, established regulations, procured equipment and facilities, prepared for the building of a center for tropical medicine, insisted on building the institute and conducting research at the same time, and wished that one day could become 2 days. Comrades at the institute saw that he was in his old age and his heart condition was not very good and advised him not to work so hard. He was told he only needed to give a few directions and the rest of the work could be done by someone else. He thanked them for their concern but refused to be "a person with nothing to do." He said: "Scientific research achievements must be done by man's two hands, not by speaking. I cannot speak but not do. Even if I die I want to die at my work post." He insisted on working even when he was ill. He held his cane and his briefcase in his hand and sometimes he brought his own food to join comrades Shao Lan [6730 5663], He Lianyin [6320 5114 0603], Xu Zhibiao [6079 3589 2871], and Gao Peizhi [7559 0160 5347] once and again to travel to Hunnan, Shanxi, Henan, Xishuangbanna in Yunnan, Lanzhou and this city to participate in conferences, conduct surveys, write academic reports, and proposed new exceptionally good diagnostic methods of and preventive measures against pulmonary distomiasis, hepatic distomiasis and black fever.

He traveled everywhere to serve the people and conducted scientific research with one heart and mind. When people mention his scientific achievements, Professor Zhong always happily reiterates that they are the results of the

support and encouragement by the party and the government. They are the fruits of collective wisdom and talent. Looking at the past and into the future, Zhong Huilan says profoundly: Human life is a time schedule. Although life is finite, to contribute towards the realization of the Four Modernizations is equal to extending one's life. He is racing against time on a new road of a long march.

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CS0: 4008

## SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

### CHINA UNIVERSITY OF SCIENCE, TECHNOLOGY GAINS GOOD RESEARCH RESULTS

Hong Kong ZHONGGUO XINWEN in Chinese 8 Oct 79 p 5

[Text] (China News Service Hefei 7 Oct) The China University of Science and Technology has recently obtained results, or results of a phasic nature, in 108 scientific research projects, of which 11 have filled out the blanks in China and 41 others have attained advanced levels domestically.

In her study of oscillation measurement with diffracted or defocused laser beams, Ren Xiaoping [0117 1420 1627], a woman lecturer in the modern mechanics department, not only has corrected the mistakes in a formula presently valid internationally, but also has developed four correct formulas, setting forth "the law of motion in a spatial diffraction field." Also, she and other comrades have together performed the work of "making use of diffractive photography to measure off-surface displacement in an entire field," thus solving "the method of conducting actual quantitative and qualitative measurements of oscillatory bodies." These two results of scientific research have been praised by international scholars in the same field of study. Concerning the study of the conversion rate of rare earth catalyzers used in the purification of automobile exhaust emission, it has been proven in actual tests that it is of a relatively high level. This result received much attention at a national academic meeting held recently to discuss atmospheric pollution and its control.

The China University of Science and Technology has also scored successes of a phasic nature in scientific research. Among the successes are the ultra-high vacuum system and physical design section preparatory to the assembly of an electron radiation synchrotron and the absorption section of a super-conductor magnetic resonance microwave spectrograph. These successes are of a definite advanced level.

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CSO: 4008

## SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

### KUNMING BRANCH OF CHINESE ACADEMY OF SCIENCES

Hong Kong ZHONGGUO XINWEN in Chinese 10 Oct 79 p 2

[Text] (China News Service Kunming 9 Oct) The Kunming Branch of the Chinese Academy of Sciences announced on the eve of National Day that in 1979 it has obtained results in 31 scientific research projects and promoted 221 high- and middle-ranking scientists and technicians.

These results of scientific research have embodied the general policy of serving the national economy and national defense construction, and attained a relatively high level. They include: the fundamental research in florology, phytotaxonomy and phytogeography, and the analytical study of the chemical composition of a family of herbs, including ginseng and pseudo-ginseng, conducted by the Kunming Institute of Botany; the study made by the Yunnan Tropical Plant Research Institute of the extraction of effective anti-cancer constituents of Mei-deng [5019 4098] and related plants; and the study and application of laser beam range finding with a camera from an earth satellite by the Yunnan Astronomical Observatory.

Among the 221 scientists and technicians promoted by the Kunming Branch of the Chinese Academy of Sciences, many are middle-aged personnel who have engaged in scientific research for a number of years and scored certain successes in their work. There are also young scientists and technicians who have won achievements through intensive study after graduating from university in recent years. Zhou Xuan [0719 6881], an assistant researcher in the Plant Physiology Laboratory of the Kunming Institute of Botany, who has persevered in searching for 12 years deep in the mountains and forests for the law governing the cultivation of Tian-ma [0719 7802], the tuber of elevated gastrodia, and found a method in carrying out the propagation of Tian-ma, was promoted to deputy researcher. Lu Ruwei [7120 3067 4850], of the Yunnan Astronomical Observatory, a 1970 university graduate, was made an exception to the rule and promoted to assistant researcher for the splendid showing in his work during the installation of a telescope 1 meter in diameter in the observatory.

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CSO: 4008

## SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

### ACHIEVEMENTS OF INSTITUTE OF HYDROBIOLOGY REPORTED

Hong Kong ZHONGGUO XINWEN in Chinese 8 Oct 79 pp 4, 5

[Text] (China News Service Wuhan 6 Oct) Since the beginning of the year, the Institute of Hydrobiology of the Chinese Academy of Sciences has fulfilled its plan of nine projects and 14 research topics. For three projects and five research topics, the 1979 research plan was fulfilled ahead of scheduled time. The results of the research on 13 of the research topics attained the advanced levels.

Professor Wu Xianwen [0124 3759 2429], a famous ichthyologist and the director of the Institute of Hydrobiology, who is guiding some young scientists and technicians in exploring the law of phylogeny of the suborder of carp in the sphere of taxonomy of freshwater fish, has finished writing seven scientific papers, including one entitled "The Phylogeny of the Suborder of Carp Among Fish." In these papers he presents a whole series of new ideas on a number of acknowledged knotty problems internationally in the identification of natural groups within the suborder of carp among fish as well as in the study of their near relationships.

Two assistants of Professor Wu, Cao Wenxuan [2580 2429 1357] and Chen Yiyu [7115 1355 3842], combined their inquiry about the phylogeny of *Lie fu yu lei* [5933 5215 7625 7352] with research on the history of the geologic development of the Qinghai-Tibet Plateau, and from an analysis of the distribution of fish of recent origin, derived the theory that after the late Tertiary period of the Cenozoic era the Qinghai-Tibet Plateau has gone through the process of three upheavals. They also presented a rough estimate of the extent of such upheavals to provide geological studies with some biological proof.

Following the extension of "hybrid carp" in 19 provinces and municipalities all over China, scientists and technicians of the Second Laboratory of the institute, in their research on adopting a method of the artificial development of female pronuclei, treated some fish sperm with gamma rays and X rays so as to excite the mature ovum of a carp, and for the first time in China successfully obtained descendants from a pure maternal heredity line. They also successfully changed some of the female carp into

male carp, filling out the blanks in research on fish breeding in our country to search for ways to quickly establish an inbred line through parthenogenesis.

Simultaneously with scoring a major success in research on nitrogen-fixing blue algae as a fertilizer source for autumn rice, scientists and technicians of the Algology Laboratory, in their study of the characteristics and mechanism of nitrogen fixation in nitrogen-fixing blue algae, selected by screening two oxygen-sensitive mutated plants capable of fixing nitrogen under conditions where there is little oxygen. They also observed for the first time internationally, and discovered, that complementary chiasmata, as well as reciprocal chiasmata, between the molybdenum, iron and albumen in the nitrogen-fixing blue algae and the iron and albumen in brown azotobacteria are vital.

On the eve of National Day, the Institute of Hydrobiology has also completed the writing or compiling of the following works: "Freshwater Algae of China," "A Collection of Pictures in Original Colors of Freshwater Fish of China," "A Record of the Algae of China, Volume 9: Family of Binary Algae," "Hydrobiology and Fishery in Lake Donghu, Wuchang," "Fish of Tibet," "Aquatic Invertebrates of Tibet," and "Algae of Tibet."

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CSO: 4008

## SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

### CHINESE ACADEMY OF AGRICULTURAL SCIENCES ADMITS GRADUATES

Hong Kong ZHONGGUO XINWEN 1: Chinese 13 Oct 79 p 7

[Text] (China News Service Beijing 12 Oct) In a move to speed up the training of personnel specializing in agricultural research, the Chinese Academy of Agricultural Sciences set up a graduate school this year and has enrolled graduate students for the first time. At present, half of the 46 graduate students accepted by eight institutes have already been admitted.

The Chinese Academy of Agricultural Sciences is a national institution of research in agricultural sciences and has 32 research institutes, with laboratories distributed in Beijing and in places throughout China. The eight institutes admitting graduate students for the first time this year are: Crop Breeding and Culture Institute, Crop Variety Resources Institute, Atomic Energy Utilization Institute, Soil and Fertilizer Institute, Agricultural Meteorology Institute, Agricultural Economy Institute, Animal Husbandry Institute, and Sericulture Institute. Other institutes will continue to take in graduate students from now on. A number of agricultural scientists have been actively training talented people. Among those who accepted graduate students this year are the well-known experts in crop genetics and breeding, Zu Deming [4371 1795 2494], Li Jingxiong [2621 4552 7160] and Bao Wenkui [7637 2429 1145]; the famous experts in soil and agricultural chemistry, Zhang Naifeng [1728 0035 7685] and Hu Jisheng [5170 3444 3932]; the animal husbandry specialist, Zheng Piliu [6774 0012 3966]; and the sericulturist, Cao Yisun [2580 6095 1327].

7682

CSO: 4008

## Engineering

AUTHOR: LI Tieying [2621 6993 2503]

ORG: Fourth Ministry of Machine Industry

TITLE: "Computers Today and Tomorrow"

SOURCE: Beijing XIANDAIHUA [MODERNIZATION] in Chinese No 4, Aug 79 pp15-17

ABSTRACT: The so-called electronic revolution since the appearance of the first electronic computer in 1946 to the fourth and fifth generations of computers and their ever enlarging applications is reviewed. The paper predicts a completely automated and completely "informationized" society in the not so distant future.

AUTHOR: FANG Yongsui [2455 3057 4840]  
XU Yongchao [1776 3057 6389]

ORG: FANG of Institute of Electronics, Chinese Academy of Sciences; XU of Institute of Extension and Application of Electronic Technology, Fourth Ministry of Machines

TITLE: "Talks on System Engineering (IV): System Planning and Management"

SOURCE: Beijing XIANDAIHUA [MODERNIZATION] in Chinese No 4, Aug 79 pp 29-31

ABSTRACT: This installment of the paper discusses the growing importance of planned management of giant industries and high-cost scientific projects, the technique and forms of analytic structure and organization, the technique of PERT [program evaluation and review technique] and its origin, the method of programing PERT, the way of estimating time requirement for jobs, and the use of PERT to shorten the time requirement. The entire paper is completed with this installment.

AUTHOR: XING Zhou [5887 5297]

ORG: None

TITLE: "Nuclear Power Stations, Pros and Cons"

SOURCE: Beijing XIANDAIHUA [MODERNIZATION] in Chinese No 4, Aug 79 pp 32-35

ABSTRACT: This paper begins the discussion by a brief narration of the incident in Three Mile Island. It concedes the fact that nuclear energy is an important energy source that cannot be ignored. It describes the nuclear furnace, the types of reactors, and the two types of nuclear power stations (the PWR and the CANDUPHW stations.) The high cost of constructing a nuclear power station, the danger of radiation, and the insoluble problem of disposal of nuclear waste are discussed as defects of nuclear energy, but the paper nevertheless acknowledges that future development of nuclear energy is necessary. The back cover of this issue is a color photograph of a shell ring of the pressure vessel for a nuclear power station being forged in a foreign country.

6168

CSO: 4009

## Oceanography

AUTHOR: ZHU Erqin [2612 5079 0530]

ORG: None

TITLE: "Incomparably Rich Mineral Zone of the Pacific Ocean"

SOURCE: Beijing HAIYANG [OCEANS] in Chinese No 9, Sep 79 pp 1-3

ABSTRACT: Numerous metal deposits were discovered to be encircling the Pacific Ocean as early as a century ago and these deposits were known to be interlinked to form a belt-like zone to extend from Latin America northward through the coastal United States, Alaska, the Soviet Union, East China, Islands of Malaya, to reach all the way to Australia, measuring more than thirty thousand km. This zone is further divided into the outer and the inner belts, while the marginal areas of the zone, the marginal basins have rich reserves of petroleum. These mineral deposits and their distribution in the Pacific Ocean are briefly described.

AUTHOR: XING Shuyuan [6717 2885 3293]  
YU Jue [0065 3778]

ORG: None

TITLE: "Application of Satellite Remote Sensing in the Oceans"

SOURCE: Beijing HAIYANG [OCEANS] in Chinese No 9, Sep 79 pp 6-7

ABSTRACT: The frequency band of satellite remote sensing data centers in the visible light to extend into a narrow realm from near the ultraviolet to near the infrared. The relatively completed technique of photography of this frequency band includes infrared photography, color photography, and artificially touched color photography (pseudo-color photography.) Aside from photographic data, satellite remote sensing also includes optical scanning. This paper briefly discusses these remote sensing techniques of an artificial satellite, and through their application, the temperature, salinity, water color, oxygen content, and chlorophyll content of the oceans are being studied and learned. Satellite remote sensing is also being applied to observe ocean tides, distribution of sea water, the sea and the atmosphere exchange, etc.

AUTHOR: GUAN Mengru [7070 1322 0320]

ORG: None

TITLE: "An Inexhaustible Source of Energy--The Power Sources of Sea Water"

SOURCE: Beijing HAIYANG [OCEANS] in Chinese No 9, Sep 79 pp 8-9

ABSTRACT: The power sources of the sea water are supplied by the sun. The solar energy causes the temperature of the surface layer of the sea water to be heated while the absorption of this heat energy varies from place to place to create a temperature differential which moves the sea water and the air. This paper explains the origin of ocean currents and air currents and methods of utilizing them to produce power. The ocean waves, the tides, the temperature differential of sea water, and the ocean currents as sources of energy and the techniques of utilizing them to generate power are briefly described.

AUTHOR: LU Yujing [7120 2509 0079]

ORG: None

TITLE: "Heavy Water and Deuterium in the Oceans"

SOURCE: Beijing HAIYANG [OCEANS] in Chinese No 9, Sep 79 pp 21-22

ABSTRACT: This paper first explains what is heavy water and its composition, deuterium, which is an isotope of hydrogen. The form of energy release of deuterium is different from that of uranium. The difference between fusion energy and fission energy is also explained. Finally, the existing methods of obtaining heavy water from sea water are mentioned, including brief introductions of the electrolytic method and the dual temperature exchange method.

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## Physics

AUTHOR: BAO Zhongxing [7637 1813 5281]  
XU Jian [1776 3444 1344]

ORG: Both of Institute of Physics, Chinese Academy of Sciences

TITLE: "Metallic Hydrogen--the Future High Temperature Superconductor and a New Source of Energy"

SOURCE: Beijing XIANDAIHUA [MODERNIZATION] in Chinese No 3, Jul 79 pp 13-14

ABSTRACT: Hydrogen normally exists in a gaseous state. Under certain condition, low temperature for example, it can be combined with any other element to form liquids or solids, such as water and hydrocarbons, but in any of the three states, hydrogen remains an insulator and not a conductor, unless under certain special condition hydrogen can be turned into a metallic conductor. In nature, metallic hydrogen has not yet been discovered. In the past decades, it has been known that under various pressure conditions, metallic conversion can occur to semiconductor germanium, silicon, gallium phosphide, silicon dioxide, sodium chloride, etc. This paper explains why does such metallic conversion occur and the principle that under sufficient pressure, theoretically all matter may be turned into metallic. Observations of such conversion of hydrogen have been reported in the United States, the Soviet Union and Japan. The authors have also carried out theoretical computation and experimental research of the subject in the laboratory in the past several years and have obtained some results and progress. No detail of these results and progress is given.

AUTHOR: CHEN Wenmin [7115 2429 2404]

ORG: None

TITLE: "From Coal to Artificial Petroleum"

SOURCE: Beijing XIANDAIHUA [MODERNIZATION] in Chinese No 3, Jul 79 pp 26-28

ABSTRACT: This paper explains the theory of adding hydrogen to coal and liquefying it to make artificial petroleum. The history of Germany's success and failure in manufacturing liquid fuel before and after the World War II is related. After the middle 1970's the cost factor changed and new artificial petroleum plants are being constructed again in that country and scheduled to be operative in 1980. Various experiments being carried out in the United States are also described. The paper predicts continued development of artificial petroleum in the future in some countries of the world.

AUTHOR: CAO Jiaoming [7559 2403 2594]

ORG: None

TITLE: "Knowledge of Modern National Defence--Ballistic-Missile-Firing Nuclear Submarine"

SOURCE: Beijing XIANDAIHUA [MODERNIZATION] in Chinese No 3, Jul 79 pp29-31,28

ABSTRACT: This paper begins with a narration of the history of ballistic-missile-firing nuclear submarines. Since the appearance of the first American nuclear submarine on 30 Dec 1959, today there are about 100 in the world: 41 for the United States, 50+ for the Soviet Union, and four of each for Britain and France. Using submarine as a missile base capable of firing missiles into the sky is described. The weakness of submarine missile bases, including the problem of under water communication at a depth of 100m is discussed. The appearance of new giant submarines in the 1980's and their possible new problems are predicted.

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